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Methodological and Neurological bases, Students' and Professors' insights, Guidelines for teaching

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Abstract

Over the past two decades, and with particular acceleration since the pandemic, online teaching has shifted from a peripheral experiment to a structural component of higher education in the United States and Italy. This transformation has produced an urgent need for scientifically grounded criteria capable of guiding institutions, departments, and instructors in the design of cognitively sustainable and pedagogically coherent online university courses. Despite the proliferation of platforms, toolboxes, and "best practice" manuals, research has not yet fully integrated learning theory, neurocognitive evidence, empirical experience, and institutional ethics into an actionable framework for online instruction. This dissertation responds to that gap. The central aim of the study is to determine how university-level online teaching can be designed so that it is simultaneously grounded in established learning theories, aligned with neurocognitive constraints and affordances, responsive to the lived experiences of students and faculty, and coherent with evolving institutional and ethical guidelines. Five research questions orient the work: (RQ1) how classical learning theories and contemporary instructional design models must be reinterpreted for digitally mediated environments; (RQ2) how neurocognitive mechanisms, attention, working memory, emotion, social cognition, sleep, circadian rhythms, shape the conditions of online learning and generate specific design principles; (RQ3) how course architecture, peer interaction, and student involvement influence undergraduate students' engagement and perceptions of online versus in-person learning; (RQ4) how faculty perceive online and hybrid teaching in terms of modality preference, design practices, technological readiness, assessment, and future directions; and (RQ5) which institutional, ethical, and technological frameworks should inform department-level guidelines for online university teaching. Methodologically, the dissertation adopts a mixed and layered approach. On the conceptual axis, Chapters I and II offer an extended synthesis of learning theories and instructional design models, followed by a neurocognitive analysis of attention networks, cognitive load, emotion,

memory consolidation, inter-brain synchrony, fatigue, distraction, and circadian rhythm research. On the empirical axis, two cross-sectional surveys were administered in UCLA's Department of European Languages and Transcultural Studies: one targeting undergraduate students enrolled in Italian language courses (n=64) and another targeting faculty teaching online or hybrid courses in the department (n=46). Both surveys were administered via Qualtrics, approved through the institutional research ethics process, and analyzed using descriptive and interpretive methods to identify patterns, tensions, and design implications. The findings reveal a layered set of results. Regarding RQ1, the theoretical analysis demonstrates that classical paradigms remain relevant but require reinterpretation: in digital contexts, constructivist and socio-cultural approaches depend heavily on technological scaffolding, while cognitivist and multimedia models gain operational precision through segmentation, signaling, and workload management. Concerning RQ2, the neurocognitive review shows that online environments can either overload attention and working memory or, when well designed, amplify encoding, dual-channel processing, and consolidation through paced interaction and multimodal representations. Regarding RQ3, student data indicate a strong preference for modular pacing, transparent LMS architecture, multimodal materials, and meaningful interaction, alongside concerns about cognitive overload, weak social presence, and assessment fairness. Addressing RQ4, faculty express cautious optimism, but their practices remain uneven and often misaligned with cognitive or pedagogical evidence; many request clearer institutional support in assessment, feedback, and the ethical integration of AI. Finally, RQ5 reveals that institutional guidelines must address not only usability but also transparency, academic integrity, privacy, and the psychological cost of surveillance-based proctoring. These theoretical, neurocognitive, and empirical findings culminate in a set of guidelines for online university teaching presented in Chapter V. The guidelines function as epistemological instruments rather than prescriptive checklists: they articulate conditions for cognitively respectful course architecture,

ethically grounded assessment, calibrated multimodality, purposeful interaction, and responsible use of artificial intelligence. The dissertation's primary contribution lies in demonstrating that online teaching is not a diminished variant of in-person instruction but a distinct pedagogical ecology whose quality depends on principled, research-informed design.

Keywords: E-learning; online teaching guidelines; neuroeducation; instructional design; cognitive sustainability; higher education; digital pedagogy.

Research problem.

Over the past two decades, and with almost brutal clarity since the COVID-19 pandemic, university teaching has slowly migrated into digital space not as a temporary emergency solution but as a durable, contested, and intellectually fertile environment. What once appeared as a marginal modality, reserved for continuing education or niche programs, now constitutes a structural dimension of many higher education systems worldwide.The dramatic expansion of online course offerings in both the United States and Italy demonstrates a fundamental and permanent shift in the academic landscape, thereby creating an urgent necessity for robust, scientific guidelines and methods for online teaching. The sheer volume of student enrollment in digital modalities confirms that distance learning is no longer a peripheral option but a structural core of postsecondary education, demanding standardized and evidence-based quality assurance. In the United States, where the present research has mainly been carried out, the ubiquity of online education across virtually all institutions (NCES, 2024) has led to massive student saturation. As of Fall 2023, approximately 25% of all U.S. university students, nearly 5 million individuals, were enrolled exclusively in distance education courses (NSCRC, 2024). This figure is now recognized as a stable baseline, signifying that one-quarter of the academic population is reliant on digital pedagogy. This level of adoption necessitated a move beyond simple conversion of lectures to video format, demanding validated pedagogical frameworks that ensure educational outcomes and equity for this vast, dedicated segment of the student population. Italy offers a compelling case of rapid expansion in despite the country's fully online education is concentrated within a small, highly effective group of eleven recognized Telematic Universities . Despite the small number of Institutions, their enrollment has experienced phenomenal growth,

Based on what emerges in ANVUR’s *2023 Report on the Higher Education and Research System*, the period stretching from the 2010/11 academic year to 2021/22 shows a marked surge in first-year enrollments.

Online universities saw numbers rise dramatically up by 444%, while traditional institutions registered a more modest increase of 11.49%. Over those same years, overall student numbers also grew: online institutions recorded a 419% jump, whereas traditional universities experienced only a slight 0.1% rise. The expansion is evident not only in student figures but also in the range of programs available. Online universities more than doubled their offerings, with a 113% increase in degree courses, while traditional institutions reported a growth of 10.18%. By the Academic Year 2022/2023, these telematic institutions enrolled over 251,000 students, accounting for approximately 13% of the total Italian university student body (Osservatorio Atenei Online, 2024). This high-impact, rapid growth in a specialized sector places significant pressure on these institutions to ensure that teaching quality and faculty readiness scale effectively alongside enrollment. The current difference in online enrollment saturation between the U.S. (25 %) and Italy (13%) should be viewed in a wider pattern of digital cultural diffusion. Historically, many significant cultural, technological, and behavioral shifts concerning digital platforms and educational technologies often emerge in the United States and subsequently diffuse into the Italian and broader European context, albeit with unique local adaptations. Given this established precedent and considering the accelerated growth rate already demonstrated by Italy's Telematic Universities, it is highly probable that the proportion of Italian students enrolled in fully online courses will continue its sharp ascent. Italy can and should proactively leverage the extensive body of methods and successful pedagogical approaches already trialed and validated within the U.S. online learning experience. By doing so, Italian institutions can potentially minimize the trial-and-error costs associated with scaling their digital offerings, accelerating the development of robust quality assurance and scientific teaching guidelines without needing to reinvent the entire digital educational model . Yet, despite the proliferation of platforms, tools, and “best practice” manuals, the epistemological and neurocognitive underpinnings of online teaching remain only partially integrated into everyday instructional design. Distance education is often treated either as a pale copy of classroom teaching, transposed onto screens, or as a technical problem of platform configuration and content distribution. Both framings are insufficient. (Ranieri 2005; Rivoltella 2021) This dissertation proceeds from a different premise: that online university teaching is a distinct pedagogical ecology in which learning theories, brain processes, institutional constraints, and lived experiences of students and faculty intersect. Consequently, any serious attempt to design effective, just, and intellectually honest distance learning must begin not with tools, but with theory and not with theory alone, but with the brain, with institutional practice, and with the voices of those who teach and learn in these mediated settings.

Background and Rationale

The starting point of this work is deceptively simple: learning has always been mediated. Print, blackboards, lecture halls, and even the choreographies of gesture and eye contact are mediating devices that shape how concepts travel between minds. With the advent of networked technologies, however, mediation becomes explicit, programmable, and inescapable. Knowledge circulates through learning management systems (LMS), video platforms, discussion forums, and multimodal resources; the "classroom" dissolves into a distributed, asynchronous, and often fragmented space of engagement. As noted in the theoretical chapter one of this thesis, this transition demands a re-reading of the classical learning paradigms, behaviorism, cognitivism, constructivism, Connectivism, not as historical curiosities but as living frameworks through which digital pedagogy can be interpreted and re-designed (Skinner, 1953; Piaget, 1970; Siemens, 2005; Vygotskij 2018). During my period of study in the U.S.A., I had the privilege of meeting Professor Richard Mayer, whose work was extensively referenced throughout the lessons of the Ph.D. program in Learning Sciences and Digital Technologies. I also had the opportunity to attend lectures and visit the renowned Mayer Lab on the Santa Barbara campus of the University of California, the site of his research. Professor Mayer advised me to focus my studies on neuro-didactics and suggested several fundamental reference publications. He also introduced me to prof. Jesse Rissman of the UCLA and I had the opportunity to visit the Rissman Memory Lab in order to widen my research into the neurological aspect of learning. This experience, combined with his valuable advice, introduced me to the intersection of neuroscience and psycho-pedagogy as it applies to mediated environments. Professor Mayer's work has been instrumental in elucidating how cognitive functions, including attention, memory, emotion, and social synchrony, operate in digital learning settings. This research highlights a critical insight: Online learning, when properly designed, is not merely "good enough"; it can, in some respects, be exquisitely tuned to the operating characteristics of the human brain. By coordinating visual and auditory channels, managing cognitive load, spacing practice, and instrumenting metacognition, digital courses can amplify encoding and consolidation in ways difficult to scale in traditional settings (Mayer, 2001, 2002, 2009, 2014 ; Sweller, 1988, 2011). Moreover, research on brain-to-brain synchrony suggests that shared understanding and social coupling can emerge even without physical co-presence, provided that interaction is carefully scaffolded (Dikker et al., 2017; Wikström et al., 2022). The neurocognitive chapter of this dissertation explores these dimensions in depth, showing that online environments can become precision habitats for learning rather than mere backups for face-to-face teaching. Yet, theory and neuroscience alone do not tell us how online teaching actually unfolds in a concrete institutional setting, with real instructors and students navigating real courses. For that, I need empirical inquiry and that is another part of the research which concentrated at UCLA’s Department of European Languages and Transcultural Studies (ELTS) so we observed how the rapid expansion of online and hybrid language instruction during the Covid 19 pandemic has generated both enthusiasm and unease. Two distinct surveys included in the present dissertation show how students value flexibility but report ambivalence about social presence, cognitive load, and the quality of interaction. Faculty innovate with tools but grapple with platform constraints, assessment dilemmas, and fatigue. The dual surveys conducted for this dissertation targeting undergraduate students in the Italian language sequence, the other faculty teaching online and hybrid courses in ELTS, offer a phenomenological and diagnostic complement to the theoretical and neurocognitive frameworks.

Finally, no dissertation on digital pedagogy can ignore the broader regulatory and ethical landscape. Institutional guidelines, quality frameworks, and policy documents seek to translate research into practice, from European Commission guidance on AI in education (European Commission, 2022) to debates on academic integrity, online proctoring, and AI-generated text detection (Werdermann & Stillig, 2022; Heil & Ifenthaler, 202). Leading universities, including Harvard, MIT, Stanford, Yale, and Italian entities such as the CRUI and the University of Padua, have converged on a small set of recurring principles: transparency of objectives, predictability of course structure, active engagement, meaningful feedback, and a recognizable teaching presence. These principles provide a normative horizon within which the guidelines proposed in the final chapter of this thesis are situated.

Research Problem and Questions

Seen from a distance, the post-pandemic university might appear to have “solved” online teaching by scaling platforms and standardizing emergency practices. A closer look, however, reveals a more intricate picture. Courses proliferated, but their design quality remains uneven; LMS architectures exist, but their pedagogical logic is not always explicit; and while many instructors have acquired technical fluency, the alignment between cognitive principles, student preferences, and institutional policies is far from guaranteed. This is also due to the fact that LMS are neutral technological tools that need to be used with method and theoretical basis The central problem addressed in this dissertation can be formulated, in deliberately plain terms, as follows: How can university-level online and distance teaching be designed so that it is simultaneously grounded in learning theory, aligned with neurocognitive evidence, responsive to the lived experiences of students and faculty, and coherent with evolving institutional and ethical guidelines? This overarching problem decomposes into more specific questions, two of which are investigated empirically in the UCLA context and others conceptually through the theoretical and guideline analysis. At the student level, the key question guiding the empirical work is:How do course design, peer interaction, and student involvement shape undergraduate humanities students' perceptions and engagement in distance learning versus traditional in-person education?At the faculty level, the survey asks, in essence:How do instructors in a research-intensive language and humanities department perceive online and hybrid teaching in terms of modality preference, design practices, challenges, LMS use, assessment, and future directions, and how do these perceptions align, or misalign, with evidence-based principles of digital pedagogy?Intersecting with these empirical questions are conceptually oriented ones:

- In what ways do classical learning theories and contemporary instructional design models (e.g., Backward Design, Universal Design for Learning, Merrill's First Principles) need to be reinterpreted when applied to digitally mediated university teaching (Merrill, 2002, 2013; Meyer et al., 2014; Wiggins & McTighe, 2005) ?
- How do neurocognitive mechanisms attention systems, memory consolidation, emotional regulation, social cognition, circadian rhythms constrain and enable online learning, and what design principles follow from this (Mayer,2002, 2009, 2014; Sweller, 2011; Immordino-Yang & Damasio, 2007; Diekelmann & Born, 2010)?
- Which institutional guidelines and ethical frameworks (e.g., around AI, surveillance, assessment integrity, and student data) should inform the construction of department-level recommendations for online teaching (European Commission, 2022; Cotton et al., 2023; Heil & Ifenthaler, 2023)?

The dissertation pursues these questions not in parallel but in sequence, weaving them into a cumulative argument: from theory to brain, from brain to local practice, and from local practice back to guidelines that aspire to be both conceptually robust and pragmatically usable.

Theoretical and Neurocognitive Framework of the research

The intellectual architecture of the thesis rests on three interlocking pillars. The first is the tradition of learning theories and associated methods. Rather than setting behaviorism, cognitivism, constructivism, and connectivism against one another, Chapter I reads them as a historical and conceptual continuum: from conditioning and reinforcement (Skinner, 1953), through cognitive information processing and schema formation (Piaget, 1952; Mayer, 2009), to the active construction of meaning in social and cultural contexts (Vygotsky, 2018) and finally to networked knowledge flows as captured by connectivism (Siemens, 2005). Social learning theory (Bandura, 1977, 1986), cognitive load theory (Sweller, 1988; Skulmowski & Xu, 2022), and andragogy (Knowles, 1980; Knowles et al., 2015; Merriam, 2001) function here not as isolated models but as operationalizations of these broader paradigms in the specific context of adult online learners. Instructional design models occupy the second pillar. Frameworks such as Backward Design, Universal Design for Learning (UDL), Merrill's First Principles of Instruction, and elaboration theory translate theoretical constructs into sequences of problems, activities, and assessments (Merrill, 2002, 2013; Meyer et al., 2014; Reigeluth & Carr-Chellman , 2009). They ask practical questions: What should learners be able to do? Which performances will show that they can do it? What experiences will bring them there? In the context of e-learning, these models must also grapple with multimedia, asynchronous pacing, and the risk of cognitive overload. Here, Mayer's Cognitive Theory of Multimedia Learning becomes a central reference point, providing empirically validated principles such as coherence, signaling, redundancy, spatial and temporal contiguity, segmentation, modality, and personalization (Mayer, 2001, 2009, 2014; Mayer & Moreno, 2002, 2003; Clark & Mayer, 2016).The third pillar is neurocognitive. Chapter II draws together findings on attention networks (Posner & Petersen, 1989; Desimone & Duncan, 1995; Corbetta & Shulman, 2002), working memory and executive control (Botvinick et al., 2001; Gazzaley & Nobre, 2012), memory consolidation and sleep (Born et al., 2006; Diekelmann & Born, 2010; Stickgold, 2005), emotion and learning (LeDoux, 2000; Pekrun, 2006; Tyng et al., 2017), stress and cognition (Lupien et al., 2007; McEwen et al., 2016; Vogel, 2016), and brain-to-brain synchrony in educational and mediated settings (Dikker et al., 2017; Stephens et al., 2010; Sato & Sato, 2025). The chapter argues that online learning is neurocognitively "plastic:" it can either exacerbate distraction, overload, and fatigue (Bailenson, 2021; Gazzaley & Rosen, 2016) or, if carefully designed, harness spacing effects (Cepeda et al., 2006; Smolen et al., 2016), dual coding (Paivio, 1986), and metacognitive scaffolds to strengthen learning (Flavell, 1979; Broadbent & Poon, 2015)

Together, these three pillars yield a simple but demanding axiom: online teaching must be cognitively sustainable. It should respect the limits and possibilities of the brain, rather than forcing learners to compensate for poor design with sheer willpower. In the later chapters, this axiom becomes the moral undercurrent of the guidelines: what is cognitively respectful is also, in a deep sense, educationally ethical.

Methodological Orientation and Empirical Setting

Methodologically, the dissertation adopts a mixed strategy. On one axis, it develops a conceptual synthesis, drawing on the learning theories and neurocognitive evidence sketched above and on institutional frameworks. On another axis, it conducts two empirical surveys within a single department at UCLA, thus anchoring the theoretical reflections in a concrete practice environment. The combination is intentional: theory without context risks abstraction; context without theory risks parochialism.

The student survey, conducted in June–July 2024, targeted undergraduate students enrolled in Italian language courses (Italian 1–6) in the Department of European Languages and Transcultural Studies. Using Qualtrics for anonymous data collection, the questionnaire comprised 25 multiple-choice items addressing, among other topics, modality preferences (online, in-person, hybrid), perceived learning efficacy, expectations regarding LMS use, preferred media formats (text, video, audio), multimedia and interactive tools, peer interaction, feedback timing, and interest in co-designing courses. The sample of sixty-four respondents was intentionally homogeneous, focusing on students engaged with online Italian instruction through UCLA's BruinLearn platform. The survey was approved by UCLA's Office of the Human Research Protection Program and designed in consultation with departmental faculty to ensure relevance and ethical compliance.The faculty survey, reported in Chapter IV, follows a parallel logic but targets instructors rather than students. Twenty items, also administered via Qualtrics and approved by the same IRB framework, explore modality preferences, technology readiness, current online teaching practices, perceived challenges, LMS importance and feature use, support needs, assessment and academic integrity, and attitudes toward emerging technologies such as AI and VR. Forty-six instructors participated, providing a cross-sectional snapshot of ELTS' online teaching culture. The analytic strategy combines descriptive statistics with interpretive commentary grounded in the literature on online teaching readiness, LMS governance, feedback, and assessment (Blundell et al., 2020; Turnbull et al., 2021; Fernández-Batanero et al., 2022; Dawson et al., 2024; Vlachopoulos, 2024; Williams, 2024).The methodological stance is deliberately modest regarding causal claims. These are observational, cross-sectional surveys; they identify patterns, perceptions, and misalignments rather than testing interventions. Their value lies in surfacing design tensions and opportunities that can then be addressed through department-level guidelines and future studies, including quasi-experimental pilots or design-based research.

Contributions and Significance

This dissertation tries to make four intertwined contributions, each corresponding to a different plane of analysis. First, at the level of theory, it tries to offer an integrated reading of learning theories, instructional design, and neurocognitive evidence specifically tailored to the context of university-level online teaching. Rather than treating cognitive load theory, multimedia learning, and andragogy, and many others, as add-ons, it tries to weave them into a coherent interpretive framework for distance education. In doing so, it proposes that instructional design in digital environments is, in effect, a form of neuroethics: it shapes not only what students learn but how their attentional, mnemonic, and emotional systems are taxed or supported (Mayer, 2021; Sweller, 2019; Immordino-Yang & Damasio, 2007).

Second, at the empirical level, it tries to contribute nuanced evidence about student and faculty experiences in a humanities-oriented, language-teaching department at a major research university. The student survey complicates the simplistic opposition between "flexible but isolating" online learning and "engaging but rigid" in-person instruction. Students express a preference for shorter, modular sessions, strong LMS support, interactive tools, and substantial involvement in course design, while still longing for social presence and real-time interaction. The faculty survey, for its part, uncovers an intermediate level of digital teaching maturity: instructors value clear course architecture and continuous assessment, but request more support for feedback design, LMS integration, and ethically grounded assessment practices, particularly in light of AI and surveillance concerns (Heil & Ifenthaler, 2023; Cotton et al., 2023; Werdermann & Stillig, 2022).

Third, at the institutional and ethical level, the thesis situates within broader debates on academic integrity, AI-supported teaching, online proctoring, and student data protection. By juxtaposing local practices with document-based frameworks (European Commission, 2022; Karran et al.,2025), it argues that guidelines for online teaching cannot be reduced to usability checklists. They must address fairness, transparency, privacy, and the psychological impact of monitoring tools. The discussion of commercial proctoring systems (ExamSoft, 2025; Honorlock, n.d.; YuJa, n.d.), and related controversies, including European legal cases, like the *Italian Bocconi university fined for illegal use of Respondus Monitor proctoring software*. (EDRi, 2021) and institutional strategies (Daily Bruin, 2021;Wedermann 2022) ; underscores the need for "cognitive justice" in online assessment: students should not bear disproportionate cognitive and emotional costs for institutional risk management.

Finally, the dissertation culminates in a set of guidelines that are neither purely prescriptive nor merely descriptive. They function as epistemological instruments rather than recipes, articulating conditions under which online teaching can remain faithful to how minds learn and to what universities claim to value. These guidelines, aimed at a general academic audience, many of whom may lack specific expertise in instructional design and pedagogy, seek to synthesize the theoretical, neurocognitive, empirical, and institutional strands into orienting criteria for course structure, multimedia use, interaction design, feedback, and assessment. In this sense, the work aspires not only to describe online teaching but to participate in its re-design.

CHAPTER I

Theoretical Foundations of E-Learning: Theories, Models, and Principles for Online Instructional Design

Introduction

As we begin to outline the theoretical foundations of e-teaching, we recognize that digital technologies have not merely added new tools to traditional instruction; they have reshaped the very spaces and rhythms through which knowledge circulates. Learning, once anchored to the classroom, the book, and the physical presence of peers and teachers, now takes place within fluid digital environments where knowledge moves across networks, platforms, and communities of practice (Siemens, 2005). Such a shift, radical in both scope and implications, requires us to rethink what we mean by "learning" itself, a notion that digital media have already begun to redefine in cognitive and social terms (Ally, 2008; Clark & Mayer, 2016). In this changing landscape, distance education becomes more than the technological translation of older forms; it becomes an epistemic change that urges us to reconsider how individuals construct, transform, and share knowledge within virtual spaces, and how instructional design might support or challenge these processes. To navigate this landscape, we inevitably must return to the major paradigms that have shaped educational thought: Behaviorism (Skinner, 1953), Cognitivism (Bruner, 1960), Constructivism (Piaget, 1970), and Connectivism (Siemens, 2005). These traditions, rather than excluding one another, form a continuum through which we interpret digital learning, from transmission to interaction, from conditioning to self-regulation, from cognitive processing to the social construction of meaning. Moreover, they provide the broad conceptual background within which more specific methodologies, social learning theory (Bandura, 1977), cognitive load perspectives (Sweller, 1988), and andragogy (Knowles, 1980) take shape. Such methods help us confront the practical realities of online environments, where attention, motivation, and prior knowledge fluctuate in ways that certainly demand thoughtful mediation.Ultimately, these theoretical and methodological layers converge in the domain of instructional design models. Frameworks such as Backward Design (Wiggins & McTighe, 2005) and Universal Design for Learning (Meyer et al., 2014) translate underlying assumptions into sequences of activities, assessments, and inclusive structures. They do not eliminate the uncertainties inherent in digital education, yet they try to offer forms of guidance that help us navigate a landscape where technological possibility often outpaces pedagogical reflection. This attempt to give the right theoretical basis to E-learning and or online teaching, it must be stressed, without delving into each paradigm, method, or model, invites us to see them as interwoven elements shaping the intellectual architecture of contemporary e-teaching. It is vitally important for distance education as well as for education in general, to consider that learning theories explain the fundamental 'how' of human acquisition, functioning as broad conceptual and epistemological frameworks (e.g., behaviorism, cognitivism, constructivism). In contrast, the learning methods that we are going to consider critically describe how to intervene in the learning process, offering operational principles or strategies that stem from those theories (e.g., social learning, cognitive load, andragogy). Instructional design models, also discussed afterwards in turn, show how to structure a learning experience by providing practical frameworks for organizing activities, content, and assessment (e.g., Backward Design, UDL).

Learning Theories, Principles, Methods, and Models as the Foundation for Effective Distance Education.

As already stated, to outline the fundamental pedagogical principles of distance teaching, which are**,** it must be acknowledged, the very same principles underpinning pedagogy itself, it is useful **t**o begin by reflecting on **Behaviorism**. Founded on the research of Watson and Skinner, this school of thought, as we know, conceives of learning as an observable change in behavior occurring in response to external stimuli (Skinner, 1938/1991). From this standpoint, the mind is not a direct object of investigation; what holds significance is the functional relationship between stimulus and response, mediated by reinforcement. Consequently, the learning environment becomes the very apparatus through which the subject is molded, and knowledge is equated with the formation of habits and automatisms (Schunk, 2012).In the e-learning domain, behaviorist principles remain recognizable in programmed instruction systems, adaptive testing, linear exercise sequences, and the use of immediate feedback to reinforce correct responses (Ally, 2008). Even current gamification practices, which reward consistency and precision through points, badges, or leaderboards (Deterding et al., 2011), derive explicitly from the principle of positive reinforcement. Although Behaviorism might seem reductionist today, it nonetheless maintains a crucial function in the foundation of distance instruction. In digital settings, where the presence of the instructor is mediated or entirely absent, immediate feedback suddenly becomes a fundamental cognitive and motivational substitute, mirroring the role of the in-class teacher in face-to-face instruction. The sequential structure and clear objectives, legacies of behaviorism, remain vital tools for cognitive regulation for the online student, who needs explicit reference points to navigate an asynchronous context. However, its limitation is undeniable: it fails to account for reflective and social learning, nor the meaning that the individual attributes to their actions. For this central reason, the behaviorist theory can only be deemed necessary but ultimately insufficient as the sole basis for online education.

With **Cognitivism**, however, the focus decisively shifts from the observable to the mental: learning is conceived as the internal re-elaboration of information, mediated by processes such as attention, memory, encoding, and retrieval (Piaget, 1952; Mayer, 2009). The objective is no longer to shape a response, but to foster understanding. The mind is regarded as a system that processes symbols, constructs schemas, and organizes knowledge within long-term memory (Anderson, 2015). In e-learning contexts, the **Cognitive Load Theory** (Sweller et al., 2019) and the **Cognitive Theory of Multimedia Learning** (Mayer, 2014;

Clark & Mayer, 2016), both of which will be explored further in this chapter, offer foundational operative principles: the reduction of redundancy, the balance between visual and verbal channels, and the segmentation of information to avoid cognitive overload. Digital learning materials, when designed according to these strict criteria, respect the student's cognitive limits and significantly enhance comprehension through the optimal management of attention.he relevance of the cognitivist theory for distance instruction is structurally critical because, in the absence of the physical and social context of the classroom, the digital environment must compensate for attentional and memory mechanisms through deliberate design. Interfaces, exposure times, information density, and even the visual pace of slides or videos are all elements that translate cognitivist principles into design practice. Yet, traditional cognitivism tends to view the mind as an isolated system and generally fails to consider the weight of social interaction and the emotional dimension—aspects which prove crucial in online learning. Therefore, while its applicability is high at the micro-design level (organization of information, load reduction), it remains partial at the socio-educational level.

A further reflection must certainly address **Constructivism**, in its dual Piagetian and Vygotskian matrix, which proposes a view of learning as the active construction of meaning (Vygotsky,2018). One of the most profoundly true and tangible principles of Constructivism in learning is that the individual does not passively receive information, but rather interprets, reorganizes, and negotiates knowledge through direct experience. Authentic and durable learning arises from problematical situations, shared socially, which necessitate collaboration and critical reflection (Harasim, 2017). In digital contexts, this approach translates into practices such as problem-based learning, project work, synchronous and asynchronous discussions, and the explicit valuing of the active role of the learner as an author and co-producer of knowledge (Powell & Kalina, 2009; Anderson, 2016), all instructional methods which have, for many years, already been employed in the best traditional teaching practices, including those in Italy.Constructivism, consequently, can represent the pedagogical core of e-learning, as within it resides the possibility of conceiving LMS platforms not merely as archives of content, but as dialogical and generative spaces. However, its effectiveness is deeply contingent upon the quality of the instructional design and the active support provided for cognitive and social participation. Distance learning finds its epistemological justification here: teaching remotely does not imply less presence, but a different kind of presence, mediated by tools that enable interaction, reflection, and negotiation of meaning. This is not without significant challenge, however: the successful implementation of these principles demands a high level of didactic and technological competence and, critically, requires significantly more time for design and material creation. This, in reality, is the true hurdle to the effectiveness of distance education; the mere availability of forums or chat features certainly does not guarantee a truly constructive learning experience. In more recent years, the theoretical-didactic basis for the cognitive transformations produced by the network emerged: **Connectivism**, as initially proposed by Siemens (2005) and further developed by Downes (2010). Under this contemporary paradigm, the understanding of learning dynamics must no longer be based exclusively on studying how the individual learns; instead, these dynamics are now distributed across networks of people, devices, and information. To truly know means being able to navigate, select, connect, maintain, and update informational nodes (Goldie, 2016). In distance education, Connectivism finds its application in MOOCs, Personal Learning Environments (PLEs), and personalized networked learning paths (Wang et al., 2014). The focus decisively shifts from the mere transmission of content to the student's capacity to construct and sustain a meaningful network of resources, thereby developing core competencies in autonomy, reflexivity, and information management (Corbett & Spinello, 2020).Connectivism, therefore, represents the most radically contemporary paradigm for comprehending distance instruction. Within this framework, learning becomes an ecological process, diffused between human and technology, where knowledge is inherently dynamic and unstable. However, its strength also contains its weakness: the proposition that knowledge resides primarily within the network risks dissolving the crucial role of the subject and, perhaps more significantly, the role of pedagogical guidance and the instructor. For this reason, while Connectivism serves as an invaluable interpretive framework for networked learning, relying solely upon it for the design of online courses risks failing to structure the instruction effectively.A separate discussion is warranted for the **Universal Design for Learning (UDL)**, which is not a learning theory nor a teaching method, because this framework has gradually become the most widely employed lens through which online courses and large-scale open environments are conceived. This is partly because it carries with it the legacy of the architectural idea of designing "for all" from the outset and partly because it offers a vocabulary capable of interpreting the inherent fragmentation of online learning.Its origins can be traced to the broader movement of universal design articulated in the 1980s, particularly by Ronald Mace and the Center for Universal Design at North Carolina State University, which advocated environments usable by the widest range of people without the need for after-the-fact accommodations (Mace, Hardie & Place, 1991). The **CAST** group later translated those premises into an educational framework structured around multiple means of representation, action and expression, and engagement (CAST, 2018). concrete illustration may be found in the "Universal Design for Learning: Explore" course offered by the Harvard Graduate School of Education, an asynchronous online program built around alternative formats, layered supports, and opportunities for students to choose how they engage with and demonstrate their learning (Harvard Graduate School of Education, 2025). A similar orientation appears in the "UDL On Campus" initiative developed by CAST in collaboration with institutions such as Stanford's Open Learning Initiative, which documents the systematic integration of UDL principles into university-level digital instruction (CAST, 2024).These designs deliberately anticipate variability by providing downloadable materials, transcripts, alternative pathways, and diverse modes of assessment.By contrast, many online courses still built around a single modality, the familiar sequence of extended video-lectures followed by compulsory quizzes, with no meaningful options for navigating content or expressing understanding, reveal the limitations of a non-UDL approach. Empirical work on MOOCs consistently reports higher dropout rates and weaker engagement in such traditionally structured environments, especially when they offer little autonomy or flexibility (Huang, 2023). In this sense, adopting UDL does not merely refine an existing model; rather, it shifts the balance from a "one-size-fits-all" pedagogy toward an instructional design conceived for diversity from the outset, where flexibility, choice, and accessibility constitute the very grammar of teaching and not a set of optional afterthoughts.

Throughout the history of pedagogy, as we already outlined, numerous learning theories have been developed, some of which are particularly significant for distance education, as they provide its epistemological basis, that is, the theoretical assumptions about how knowledge is generated and structured. In this context, it is useful to reflect on some of these theories that may be considered more congenial and relevant for the theoretical foundations of online teaching, even though reflecting on only a few of these theories is not intended to be entirely exhaustive in constituting a theoretical basis. Another approach that warrants consideration is **Social Learning Theory**, through which Bandura (1977; 1986) highlighted how a great deal of human behavior is learned through observation, imitation, and modeling. His theory integrates behavioral and cognitive dimensions, acknowledging the central role of the social environment as a mediator of learning. In e-learning—which might initially seem strange, given that sociality is constrained by distance—this must translate into practices of peer modeling, collaborative forums, formative social networks, and the observation of performance (Alqurashi, 2016; Hung & Yuen, 2010). Bandura's theory can, therefore, represent the psychological foundation of the virtual learning community. Observational imitation, in the digital realm, becomes a form of collective intelligence. Students must be enabled to observe the strategies, styles, and errors of their course colleagues, just as happens in traditional instruction, thereby building identity and social competencies. In this sense, e-learning must not be defined by technological solitude; the distances must be broken down by digital sociality, through dialogues, forums, and continuous interaction between course peers. Bandura, consequently, provides the theoretical justification for conceiving the communal dimension of online instruction, yet he also calls for ethical care in these interactions.

Continuing this brief analysis of theories that could inspire the effective design of Online courses there is another theory that is useful to consider and that's the e **Elaboration Theory** proposed by Reigeluth as a principle of progressive organization. For formative actions to achieve greater success, one must start from a general overview of the content and gradually deepen it, expanding complexity. In the digital sphere, this approach should guide the design of hypertextual paths, adaptive systems, and courses of increasing difficulty (Van Merriënboer et al., 2003). Research by English and Reigeluth (1996) demonstrates that such a structure favors conceptual understanding and knowledge transfer.E-learning, by its very nature, odular and navigable in the case of asynchronous activities—is perfectly suited to the application of Elaboration Theory. It furnishes the cognitive grammar of hypermedia design: start with the core, then branch out. It represents a pedagogy of gradual complexity, one that allows each learner to follow their own rhythm. However, in the online context, freedom of movement can easily transform into cognitive dispersal: a planned directorial approach is thus required to maintain both coherence and orientation.

Considering that distance education, following the end of the COVID-19 emergency, is predominantly utilized for adults, both at the professional and university levels, the concept, or theory, of **Andragogy**, introduced by Knowles (1984; Knowles et al., 2015), is also exceptionally pertinent. It describes adult learning as an autonomous, experiential, and problem-oriented process. An adult truly learns when immediate utility is perceived, when new knowledge can be integrated with their existing experience, and when they maintain control over the learning path (Merriam, 2001; Cercone, 2008).E-learning, consequently, finds its anthropological legitimation in Andragogy. The andragogical principles of self-regulation, intrinsic motivation, and contextual learning inherently coincide with the logic of digital instruction. It must be cautioned, however, that this valued autonomy, if not robustly accompanied by adequate support structures and proactive feedback, can easily devolve into abandonment or dropout.

Still within the framework of e-learning more congenial to adults than adolescents, it could be crucial also to consider and reflect upon **Cognitive Apprenticeship**, a model proposed by Collins, Brown & Newman (1989). According to the foundational postulates of this model, learning occurs through modeling, coaching, and gradual scaffolding until true autonomy is achieved (Brown et al., 1989). Its key techniques, modeling, coaching, and scaffolding, work specifically to render the expert's mental processes visible.In e-learning, this refined approach must translate into demonstrative videos, guided exercises, personalized tutoring, and dynamic feedback (Dennen & Burner, 2008). Empirical studies (Liu, 2005; Wang & Bonk, 2001) consistently confirm the model's efficacy for the development of complex and metacognitive competencies. With these premises, Cognitive Apprenticeship, in effect, offers a sophisticated response to the problem of "cognitive distance" in e-learning. In a context where direct experience is mediated by the screen, modeling, that is, watching an expert think, explain, and even err becomes the most effective form of pedagogical presence. The instructor is no longer merely a transmitter but a digital mentor who actively makes their own thought processes visible. This model grounds distance instruction upon a principle of cognitive transparency: learning as a shared process. The challenge remains substantial, however: maintaining the authenticity of this interaction in an artificial environment is profoundly difficult. Furthermore, this model is inherently more suited to professional training courses, corporate upskilling, and employee development. A final critical risk is the automatization of mentoring, reducing it to static videos or mechanized feedback loops.

Continuing chronologically with the analysis of the theories most suitable for distance education to be considered as theoretical foundations, **Merrill's First Principles of Instruction** (2002; 2013) deserve focused attention. With these, the scholar proposes a model centered on a problem-centered approach and unites the common principles across diverse learning theories into a coherent framework. His five phases, Activation, Demonstration, Application, Integration, and the overall Task-centered approach, delineate a cycle where learning arises from engaging with real problems, is supported by the demonstration of solution strategies, consolidated through application, and finally integrated into personal experience. Lee and Koszalka (2016) underscore how, in e-learning, applying Merrill's principles significantly increases engagement and knowledge transfer, especially when instructional tasks are authentic and contextualized. In distance instruction, where one of the main risks is the fragmentation and abstraction of content, the problem-centered model restores cognitive concreteness: it anchors learning to meaningful situations, even if these are simulated or mediated by the screen. It must be conceded that this theory presents challenges in its application across all disciplines taught online and is also difficult to implement practically. However, if one were to strive to apply its cardinal principles to the maximum degree possible, with the minimum expenditure of time for the design and implementation of didactic materials, the shift from a passive lecture to a situated experience would grant the student a greater role as a protagonist, significantly reducing passivity.

As a theoretical basis for distance teaching, apart from all the considered theories and methods, there are the teaching design models that could strongly help in designing effective online courses. The model that can be most instrumental to the foundation of university distance learning, however, is the **Backward Design model**, which today represents a methodological framework of reference for the design of coherent and cognitively sustainable courses (Wiggins & McTighe, 2005).This model involves a "planning backward" process articulated in three critical stages: defining the desired learning outcomes, identifying the acceptable evidence of learning, and only then designing the instructional experiences. Applied to distance teaching, this logic ensures consistency between objectives, activities, and assessment, thereby reducing cognitive dispersal and pathway heterogeneity (MIT Teaching + Learning Lab, n.d.).For example, in an online course on the History of the Italian Language, the instructor might formulate a general objective that the student, at the module's conclusion, "recognizes and interprets the main evolutionary phases of Italian vernacular from the 13th to the 16th century, understanding its cultural and identity implications." This goal, expressed in terms of observable learning outcomes, constitutes the starting point for the design. The second phase, that of acceptable evidence of learning, would involve designing authentic evaluative tasks: for instance, a digital portfolio in which the student analyzes a text by Dante or Boccaccio, commenting on the linguistic choices in relation to the standardization phenomena of the vernacular; or a synchronous discussion in which they argue, with philological references, the differences between literary Tuscan and Northern vernacular.Only at this juncture are the learning activities defined, selecting digital tools functional to the objectives and the evidence. The instructor might prepare asynchronous video lessons on the main historical-linguistic milestones, integrated with interactive maps that visualize the diffusion of regional vernaculars; propose platform forums for discussion on literary texts; and finally, guide collaborative linguistic analysis exercises on digitized manuscripts during synchronous sessions.

Crucially, every activity is explicitly linked to an objective and a verification method, following the principle of **constructive alignment**

(Biggs, 2014), thereby guaranteeing a logical and transparent progression. This approach, widely adopted in contexts of university excellence (Harvard, Stanford, MIT) and also at UCLA where the field research discussed in chapters II and III took place, integrates smoothly with the **Community of Inquiry (CoI)** paradigm (Garrison, Anderson & Archer, 2000), which identifies cognitive, social, and teaching presence as the three essential dimensions of online learning. In the case of the History of the Italian Language course, for example, cognitive presence is manifested in critical reflection on the texts; social presence in the interactions between students in the forums; and teaching presence in the intentional orchestration by the instructor, who manages materials and activities to guide the students' thinking toward deep comprehension. Even in Italy, the CRUI (2017), in its Guidelines for MOOC design, recommends an analogous outcome-based approach, founded on declared objectives, integrated activities, and explicit evaluation criteria. In summary, Backward Design applied to online university teaching allows for the transformation of instruction from a sequence of content into an experiential path of knowledge construction, in which every element, video, forum, exercise, and feedback is functional to a declared and shared educational goal. In this sense, it does not simply represent a planning technique, but a genuine epistemology of didactic coherence.

Continuing this discussion on the theoretical basis of effective Online teaching , it might seem reckless to consider **Bloom's Taxonomy** as a fundamental basis for digital and, more specifically, distance education, yet this cognitive taxonomy, as revised by Anderson et al. (2001), suggests organizing educational objectives according to a hierarchy ranging from Remember to Create. With the advent of digital technologies, Churches (2008) proposed an adaptation, the **Digital Bloom's Taxonomy**, where each cognitive level corresponds to activities typical of the digital environment: for instance, analyzing through data mining tools, evaluating by discussing in forums, and creating by designing multimedia content. In online contexts, where the temporal and spatial fragmentation of learning demands a much more explicit and intentional alignment, this model has found tangible applications: Page (2022), for example, utilizes the revised taxonomy to structure an online university initial teacher training course, combining scaffolding activities and the writing of multiple-choice questions mapped to the different cognitive levels. This demonstrated, across multiple cohorts, a statistically significant increase in the production of higher-order questions by the students. Bloom's Taxonomy can function as a cognitive map for e-learning: it makes visible what often remains implicit in the digital realm—the progression of mental complexity. It allows for the construction of paths that guide the learner from content consumption to knowledge production, restoring depth to the formative process. However, the risk in a virtual environment is the illusion of complexity: digital activity can appear creative while remaining superficial. Applying the taxonomy remotely thus demands a didactic intentionality that transforms digital tools into vehicles for authentic reflection. Bloom, digitally reinterpreted, reminds us that technology does not replace the mind; it amplifies the mind only if it is guided by conscious cognitive logic.Within the scope of defining theoretical basis to digital and online instruction, it might seem simplistic to reflect nowadays on Gagné, but his research profoundly influenced didactics starting from the 1980s, and his reflections have since entered instructional practice and remain essential prerequisites for avny kind of instruction. Even though elaborated decades ago within **R. M. Gagné's** broader framework of "Conditions of Learning" (1985), his **Nine Events of Instruction** remain foundational to any sound method of teaching, including that of distance education. As is well known, Gagné identifies nine instructional events corresponding directly to the phases of the cognitive process: gaining attention, stating objectives, stimulating recall of prior learning, presenting content, providing guidance, eliciting performance, giving feedback, assessing performance, and enhancing retention and transfer (Gagné et al., 2005). In the context of e-learning, these "moments," which are consistently present across all instructional methods and models, furnish a robust cognitive architecture in which every module can be constructed as a complete didactic microcosm (Beldarrain, 2006). This structured approach has been empirically validated: Studies by Miner et al. (2015) and Kruger et al. (2015) demonstrate that online courses, which incorporate all phases (including those in contexts such as nursing), achieve better learning outcomes and higher completion rates.Gagné's nine events endow online instruction with a crucial pedagogical rhythm. In the absence of a physical classroom, the course becomes a rhythmic narrative of stimuli, pauses, and responses. Each event marks a specific act of learning and grants the student a sensation of progression and mastery. However, the core challenge for e-learning is to preserve the experiential vitality of this sequence, preventing it from devolving into a mechanical schema. The model's true strength lies in its dramaturgical potential: the online course as a cognitive representation, where every phase is an act of meaning construction. Thus reinterpreted, Gagné is not merely a theorist of process, but the invisible director of distance learning.

Another milestone in modern learning theories has been elaborated and refined over the years by Richard Mayer (2008; 2014; 2017), who developed the systematic foundations of multimedia learning based on the interaction between the mind and media. According to Mayer, the human mind possesses two main channels for processing information, visual and verbal, each with limited capacity. Learning occurs when the student successfully selects, organizes, and integrates content from both, thereby building a coherent representation (Mayer & Moreno, 2003; Clark & Mayer, 2016).From these premises derive **twelve design principles**, including:Coherence – Signaling – Redundancy - Spatial continuity - Temporal contiguity - Segmentation Modality - Personalization - Human voice.

All aim to reduce extraneous processing, manage essential processing, and foster generative processing (Mayer, 2008). In e-learning, their application is indispensable; the imperative is to reduce text superimposed over images, use oral narration to accompany graphics, segment long videos into short modules, or personalize language to increase engagement

(Moreno, 2006).A systematic review of 136 studies conducted in traditional, virtual reality, and augmented reality contexts confirms that the design principles derived from multimedia theory, particularly those relating to modality, redundancy, and signaling, continue to explain differences in learning even in immersive environments, albeit with an empirical base still under consolidation (Çeken & Taşkın, 2022). Mayer's principles offer an invisible grammar that orders the perceptual complexity of the digital realm. In a world where knowledge travels in audiovisual and hypermedia forms, Mayer reminds us that learning is not just exposure to information, but the active construction of meaning under precise cognitive constraints. For distance instruction, these principles represent the neurodidactic structure upon which clarity is founded. They account for how the mind functions and direct the design: every graphic choice, every moment of waiting or pause in a video, becomes a pedagogical act. However, their strength risks transforming into formalism if applied mechanically, since the true art of the online instructional designer lies in perceiving the subtle boundary between simplification and cognitive impoverishment. Applying Mayer's principles does not mean reducing complexity, but taming it so that it becomes comprehensible without annihilating its density.

Alongside Mayer's cognitive principles, the principles of **visual design** formulated by Williams (2014) and elaborated by Lohr (2008), namely: Contrast – Repetition –Alignment - Proximity **(CRAP)**, act at the perceptive and aesthetic level. They are not mere graphic embellishments, but conditions of cognitive legibility: the mind organizes visual information according to patterns of similarity, balance, and distance.Pett and Wilson (1996) empirically demonstrated that materials based on these principles produce greater retention and reduced cognitive load compared to disordered or inconsistent layouts. Malamed (2015) clarified how, in digital environments, visual quality is not simple aesthetics, but visual pedagogy. Distance instruction, more than any other form of education, is an act of designing the gaze; where there is no body, gesture, or intonation, all didactic power is concentrated in the way the text and image are offered to the learner's eye. The principles of contrast, alignment, and proximity are not merely graphic rules: they constitute the visual rhetoric of knowledge. They determine whether a concept will be grasped easily or lost in a perceptual fog. For online instruction to be effective, it must acknowledge that learning passes not only through the intellect but also through perceptual sensitivity: the brain learns through visual harmony, spatial coherence, and rhythmic predictability. In this perspective, design becomes a pedagogical and ethical act: it is not about "beautifying" learning, but about constructing an experience that respects the subject's cognitive physiology and mental aesthetic.Ultimately, visual design is the silent grammar of e-learning , that which allows knowledge to become visible, readable, and hospitable.

Instructional Design Models for E-Learning

A more pragmatic and practical expression of teaching methods is constituted by instructional design models, which represent the systematic concretization of learning theories. They translate psycho-pedagogical principles into operational processes, structured by phases, procedures, and feedback loops. If theories provide the conceptual categories, models offer the structure that allows the designer to move from formative intention to didactic realization. In e-learning, where design largely replaces the physical presence of the instructor, such models assume a foundational role, representing the pedagogy incarnated in technology for e-learning.

Beginning this analysis of models most suitable for distance education, the **ADDIE model** (Analysis, Design, Development, Implementation, Evaluation) warrants attention, as it constitutes the reference matrix for a large part of modern instructional design (Branch, 2009). Though born in the 1970s as a linear process, it is now interpreted as a cyclical and iterative structure (Molenda, 2003), where each phase feeds the next and is open to continuous revisions.Within the scope of e-learning, ADDIE enables the management of the complexity of the design cycle: analyzing learner needs, designing the content architecture, developing digital materials, implementing the course on the platform, and evaluating its effectiveness (Aldoobie, 2015). Allen (2006) has shown that the systematic use of ADDIE produces courses that are more coherent and higher-performing compared to projects conducted haphazardly. Peterson (2003) underscored its versatility, capable of adapting both to corporate training and online university settings. ADDIE represents the methodological backbone of distance instruction. Its procedural rigor compensates for the instructor's physical absence, offering a cognitive structure that guarantees coherence and traceability. Yet, this very strength is also its limitation: an overly rigid application can stifle pedagogical creativity, transforming design into bureaucracy. In a dynamic digital context, ADDIE must be reinterpreted as a living process, not an assembly line: every phase must remain open to student feedback and technological transformations. Thus, the model becomes not only a methodology but a reflective praxis of teaching online.

In distance instruction, motivation is not merely a prerequisite but a condition that must be actively constructed, as highlighted in Chapter II. **The ARCS Model** (**A**ttention, **R**elevance, **C**onfidence, **S**atisfaction), therefore, constitutes one of the most effective architectures for maintaining the cognitive energy of the isolated student (Keller, 2008; 2010). However, online motivation cannot be reduced to strategies of entertainment or reward; it must be founded upon personal resonance between the learner and the content. Attention is not merely captured—it is taught and built through experiences of success. ARCS thus invites us to conceive of e-learning as an affective ecosystem, where the emotional dimension is an integral part of the knowledge process. It is a model that unifies psychology, ethics, and design, thereby restoring the humanity to digital education. Keller proposed the model to integrate the motivational dimension into instructional design. For learning to be sustainable, it must attract Attention, appear Relevant, generate Confidence in one's own abilities, and culminate in Satisfaction. Milman and Wessmiller (2016) and Li and Keller (2018) have shown that online courses designed according to these principles significantly reduce dropout rates and increase engagement.

There is another model that embodies the epistemological philosophy of the digital era, conceiving of knowledge as a process of continuous approximation: the **SAM model**. Allen (2012; Allen & Sites, 2012) proposes SAM as an agile alternative to linear design processes. Based on rapid prototyping, collaboration, and continuous interaction, it allows for adaptation to constantly changing contexts. Jung et al. (2019) highlighted that e-learning projects adopting SAM produce more innovative and learner-centered results compared to those developed using traditional methodologies. In e-learning, where digital tools change with astonishing speed, it becomes essential to know how to review one's work and adapt didactic solutions as new needs emerge. This attitude of continuous change is not simply an operational technique, but a way of thinking that helps instructors and designers keep courses effective, updated, and genuinely close to student needs. Error becomes part of the process; feedback, a form of collective knowledge. This model expresses the same connectivist logic that permeates the web: learning as a network of iterations. However, its agility risks sliding into improvisation if a solid theoretical framework is lacking. SAM only functions if it is supported by a reflective pedagogical vision that gives meaning to speed. The very identity of digital instructional design rests in this delicate balance between rigor and flexibility.

Integration Between Theories and Instructional Design Models: Epistemological Perspectives

Every learning theory and every instructional design model arises from a partial vision of the mind and knowledge. Precisely because of this, their maximum value is revealed not in isolation, but in epistemic integration.

As Reigeluth and Carr-Chellman (2009) observe, mature instructional design succeeds when it manages to combine the contributions of Behaviorism (rigor and feedback), Cognitivism (organization and information processing), Constructivism (authenticity and participation), and Connectivism (network and dynamic flow). No single theory, by itself, is capable of describing digital learning in its totality, as it is ecological and trans-theoretical: it thrives on interactions between mental processes, social contexts, and technological environments. Clark and Mayer (2016) emphasize that effective e-learning requires a "dynamic balance" between structure and freedom, guidance and discovery, linearity and flexibility. Bonk and Graham (2006), by introducing the notion of blended learning, showed how the synergy between presence and distance, human and digital, represents not a contradiction but a new form of pedagogical continuity.This amounts to a holistic paradigm that does not replace preceding theories but reconciles them within the perspective of design for learning, where the focus is no longer the theory itself, but the quality of the resulting formative experience.Dennen and Burner (2008) suggest that e-learning should be viewed as the intentional design of both cognitive and affective relationships, where the instructor is framed as an architect of mental environments and the learner acts as a co-author of their own path. The integration of theories represents the epistemological maturity of e-learning. In a context where the fragmentation of knowledge is a constant risk, the ability to weave connections between diverse models becomes the sign of scientific awareness and a profound didactic vision. Distance instruction, by its very nature as a hybrid space, compels pedagogy to overcome historical dichotomies: theory and practice, content and form, instructor and learner, presence and absence. E-learning is the dialectical synthesis of these polarities. Every effective online course should be the result of a continuous mediation between the rigor of ADDIE and the flexibility of SAM, between the linearity of Gagné and the network of Connectivism, between the taxonomy of Bloom and the motivation of ARCS. This integration is not a compromise, but a form of design intelligence: the art of navigating complex systems while maintaining cognitive coherence. In this sense, e-learning is not just an applied field, but may represent the concrete development of a new educational epistemology founded on interconnection, reflexivity, and conscious design to provide a didactic dimension to distance.

The theories and models examined converge toward a common principle: learning, even when mediated by technology, remains a human, situated, and intentional act. The digital realm does not abolish pedagogy; rather, it demands a more complex and conscious reformulation of it. As Laurillard (2012) observes, "computer-mediated teaching is not a reduction of human teaching, but its extension through new languages and new media" (p. 89).

The analysis of behaviorist, cognitive, constructivist, and connectivist theories demonstrates that distance instruction is not a deviation from tradition, but its necessary evolution, the arena where pedagogical reflection meets technological mediation. The design models, from Merrill's problem-centered approach to Allen's agile model, represent the operational forms of this transformation: they translate theory into action, cognition into interface, and the educational relationship into architecture.The neuroscience of learning, discussed in the preceding chapter, confirms that online learning can be just as effective, and in certain cases, more profound, if it respects the biological structures of the mind: attention, memory, motivation, and emotion. Instructional design thus becomes a neuroethical act: constructing environments that not only inform but also protect and potentiate the mind. While distance instruction originated as a necessity, today it is configured as an epistemological opportunity. It compels pedagogy to reveal what is truly essential: relationship, design, and care. In this sense, distance is not an obstacle but a test of truth for learning theory: what works at a distance is what is authentically educational. E-learning, in its best forms, is not less human than the classroom; it is simply more conscious of its own mediation.The task of contemporary pedagogical research is therefore not to bridge the distance, but to design it: to make it habitable, meaningful, and generative.Only when distance instruction is capable of becoming a space for thought and not merely transmission, can we truly say we have transformed technology into pedagogy and connection into knowledge.

CHAPTER II

Neurocognitive Dimensions of Online Learning Environments

Introduction

From a neurological perspective, e-learning and in-person education engage the brain in distinct yet partially overlapping ways, giving rise to characteristic advantages and disadvantages in each modality. Understanding those differences is not merely a matter of instructional taste; it is a question of how learning is constrained and enabled by neural architecture and by the environmental contexts in which information is encountered. In this chapter I therefore examine the neurological underpinnings of e-learning with particular attention to the ways digital environments recruit and coordinate cognitive systems differently from traditional face-to-face instruction. The discussion spans a set of interlocking neurocognitive and affective processes, memory formation and re-elaboration, attention regulation, cognitive load, emotional processing and the dopaminergic reward system, sensory integration, neuroplasticity, and inter-brain synchrony during synchronous interactions. These dimensions are central for explaining how learning unfolds online and, more importantly, for grounding the pedagogical and technological design of e-learning environments. When instructional strategies are aligned with how the brain encodes, organizes, and retrieves information in digital settings, we can deliver learning experiences that are more effective, inclusive, and neurologically coherent.

Memory Formation in Digital vs. Physical Learning Environments

The formation, storage, and retrieval of memory are deeply shaped by spatial and contextual cues, which function as powerful anchors for episodic recall. Tulving and Thomson's (1973) principle of encoding specificity holds that recall is strongest when the retrieval context resembles the conditions present during encoding. Traditional classrooms naturally support this principle: stable features such as room layout, habitual seating, shared materials, and the predictable rhythm of co-present instruction provide a coherent spatial scaffold that ties content to place and social situation. These cues do not merely decorate the learning experience; they bind together heterogeneous elements, words, diagrams, gestures, smells, moods—into a trace that can later be reassembled when a similar context is encountered.

Digital environments, by contrast, often lack such stability and richness of context. Learners log in from different rooms and devices, switch between platforms, and experience interfaces that vary across instructors and courses. This variability weakens the availability of consistent spatial cues and can hinder both encoding and retrieval. The classical method of loci (memory-palace technique) illustrates the point. The technique exploits spatial memory by asking the learner to map ideas onto familiar locations and then "walk" through that space to retrieve them. In the absence of an immersive and navigable environment, one that supplies persistent landmarks and an embodied sense of movement, the benefits of loci are harder to realize. Without careful design, the screen dissolves the very spatiality that the hippocampus relies on to build durable cognitive maps.

A converging line of evidence comes from work on hippocampal coding. Bellmund et al. (2018) demonstrate that the hippocampus, essential for both episodic memory and navigation, organizes information using spatial codes and grid-like representations. When physical navigation and salient landmarks are missing, as in many default online platforms, these cognitive maps are impoverished. The consequence is not only a reduction in recall for specific items but a more general difficulty in structuring knowledge within a coherent spatial framework. Unless digital learning experiences introduce consistent, meaningful spatial structure, through stable dashboards, recognizable "rooms," or virtual environments that learners can repeatedly traverse, spatially anchored strategies like loci will be less effective than in physical classrooms.

Memory consolidation underscores the same challenge from a temporal angle. Consolidation refers to the gradual process by which newly encoded traces are stabilized and integrated into long-term stores. The hippocampus initially serves as a binding hub, linking together sensory, semantic, and affective features of experience before traces are progressively redistributed to neocortical networks for durable storage (Alvarez & Squire, 1994). During offline periods, especially slow-wave sleep, the hippocampus "replays" recent experiences, strengthening cortico-hippocampal connections (Diekelmann & Born, 2010). Online learning can interfere with this process in several ways. Fragmented attention, habitual multitasking, and shifting contextual cues disrupt the coherence of encoding; when the initial trace is noisy and poorly bound, subsequent consolidation has less to stabilize (Kahana, 2012). Moreover, because many digital courses lack embodied engagement, movement through space, manipulation of objects, shared gaze and gesture, the multisensory richness that scaffolds hippocampal binding and later replay is reduced (Macedonia, 2019). By contrast, the physical classroom continually supplies converging visual, auditory, tactile, and proprioceptive signals that become part of the memory trace and can be re-evoked at retrieval.

These constraints are not inevitable; E-learning design can simulate coherence and supply stronger retrieval cues by maintaining consistent visual layouts, establishing persistent "locations" within the platform (e.g., a stable left-hand navigation, a dedicated room for discussion, a fixed placement for weekly materials), and encouraging active engagement through interactive simulations and multimodal presentation (text, audio, animation, video). Under such conditions, the hippocampus has more structured material to bind, and learners can form, rehearse, and retrieve richer traces (Mayer, 2009). Indeed, Dresler et al. (2017) show that training in the method of loci enhances recall and produces neural patterns akin to those of memory champions; the implication for digital design is to provide virtual spaces and landmarks that make spatial strategies practicable online.

Challenges in Digital Contexts

Even with thoughtful design, online environments present characteristic stressors for memory. The device itself is a portal to competing goals: notifications, messaging, and parallel tabs siphon attention, increasing the probability of shallow encoding. The absence of co-present peers and instructors can attenuate social arousal and accountability, both of which modulate dopaminergic reward and readiness to consolidate. Variability in access conditions—headphones one day, phone speakers the next; quiet desk today, noisy kitchen tomorrow—further destabilizes context-dependent cues. All of these factors combine to make memory formation less efficient unless design and habit intentionally counteract them.

Enhancing Digital Learning with Spatial Strategies

A practical response is to introduce spatial structure and ritual into the online course. Use consistent page architecture and iconography so that the "map" of the course becomes second nature; incorporate interactive environments and virtual "rooms" that learners revisit; add visual landmarks to modules so that content can be associated with recognizable places. Where possible, embed low-friction opportunities to rehearse spatially, e.g., concept journeys that return to the same sequence of "stations," or 3D/VR walkthroughs when appropriate and accessible. Empirically, method-of-loci training improves memory even outside physical settings and elicits champion-like neural signatures (Dresler et al., 2017). The design goal is not to mimic brick-and-mortar classrooms nostalgically but to achieve functional equivalence: stable cues, navigable structure, and opportunities for embodied rehearsal.

Mechanisms of Memorization and Re-elaboration

Memory formation begins when attention selects incoming information for working memory. In that moment, coordinated activity in fronto-parietal networks channels content into a limited-capacity workspace, while hippocampal synapses undergo long-term potentiation (LTP) that strengthens connections among co-active neurons, an essential substrate for encoding (Kandel et al., 2021). Within hours, synaptic consolidation stabilizes these changes through molecular cascades and gene expression (Dudai, Karni, & Born, 2015). Over days to months, systems consolidation progressively redistributes memory representations from the hippocampus to distributed neocortical regions; hippocampal sharp-wave ripples during sleep replay encoding patterns, rehearsing and gradually transferring them to cortical circuits (Dudai,2012).Once formed, memories are not fixed. Each retrieval episode reactivates the trace and renders it temporarily labile, opening a window for modification, a process known as reconsolidation. Functional connectivity analyses show that recall coordinates the hippocampus (for pattern completion), the prefrontal cortex (for goal-directed control and evaluation), and parietal regions (for attentional orienting), reinstating neural patterns from encoding while also integrating new details (Ranganath et al., 2005). This malleability is educationally consequential: when learners revisit a concept, misconceptions can be corrected and new information woven into the existing schema (Nader et al., 2000).

Consider a student studying biochemical pathways. In early learning, hippocampal LTP stabilizes associations between enzyme names and functions. Elaborative strategies—drawing metabolic maps, generating real-world analogies, or constructing mnemonics—engage neocortical systems responsible for semantic integration, expanding the network of meanings and deepening the code. During slow-wave sleep, hippocampal replay re-engages these circuits, gradually transferring traces to the neocortex where they are reorganized within pre-existing cognitive structures; the result is a more stable memory that is easier to access in the future. Later, active retrieval, via self-testing, teaching a peer, or applying the concept in problem-solving, both strengthens and updates the trace, incorporating new connections or clarifications (Born & Wilhelm, 2012).

In online learning, the core neural machinery of encoding, consolidation, and re-elaboration operates just as it does offline (Dudai, 2012; Dudai, Karni, & Born, 2015). What differs are the surrounding conditions that modulate efficiency. Emotional activation is one axis of difference. In face-to-face classrooms, non-verbal signals, eye contact, posture, gesture, prosody, reliably trigger affective responses in limbic circuits, which enhance motivation and tag experiences for consolidation. Many online settings dampen such cues, risking lower emotional salience. However, when platforms are designed to foster social presence, through live video, breakout discussions, shared whiteboards, or embodied simulations, some of these affective advantages can be recovered (Pekrun, 2006; Immordino-Yang & Damasio, 2007).

Sustained attention is a second axis. Screens are dense with competing stimuli: alerts, background apps, and frictionless task-switching opportunities conspire to fragment focus. Empirical work shows that heavy media multitasking recruits control networks yet increases distractibility and undermines deep processing (Ophir et al., 2009; Moisala et al., 2016). E-learning therefore, benefits from deliberate attention design: chunking content into meaningful segments, pacing activities to encourage periodic recall, engineering quiet periods for deep work, and minimizing non-instructional interface clutter.

A third axis concerns cognitive load. Online courses often require learners to navigate platforms, manage multiple windows, and interpret materials of uneven structure. Such extraneous demands consume working-memory resources that ought to be reserved for germane processing. Cognitive Load Theory predicts, and practice confirms, that reducing extraneous load, through consistent navigation, clear signaling, and progressive disclosure, improves comprehension and transfer (Sweller, 1988; Sweller, Ayres, & Kalyuga, 2011).

Finally, multisensory engagement differs across modalities. Physical classrooms naturally provide a richer sensory environment: listening to a lecture while viewing diagrams on a board, writing notes by hand, manipulating physical models, and orienting in space among peers. These streams converge in sensory cortices and associative hubs and are bound by the hippocampus into robust, interconnected traces. Online platforms risk narrowing this palette to primarily visual-auditory input delivered through a flat screen. Yet design can offset the limitation. When digital instruction follows multimedia principles, coordinating visuals with narration, sequencing interactions to avoid split attention, and adding low-stakes practice, it leverages dual-channel encoding and multimodal processing to enhance retention (Mayer, 2009; Macedonia, 2019).

Google effect in the memory formation process

Sparrow et al. (2011) documented the "Google effect": when people expect information to remain accessible online, they preferentially remember how to find it rather than the information itself. In digital courses, this can subtly shift study strategies toward externalized retrieval—remembering file paths, forum threads, or search terms,at the expense of internalized content. Rather than resisting this shift outright, instructors can harness it by designing tasks that require both: anchored knowledge of core ideas and skill in locating and validating supplemental information. Assessments can, for example, ask learners to explain a concept from memory and then extend or qualify it using sources they locate, thereby integrating internal recall with effective information foraging.

Multi-Sensory Encoding vs. Screen-Centric Input

Empirical findings underscore the benefit of well-designed multimedia over purely text-based instruction. In an introductory physics course, students who engaged with interactive multimedia modules outperformed those using textbook materials not only on immediate assessments but also on delayed tests administered two weeks later (Stelzer et al., 2009). Complementary evidence from health-professional training shows similar effects: in a randomized trial with third-year optometry students preparing for B-scan ultrasound, interactive multimedia led to approximately 20% higher procedural performance and an 8% advantage in knowledge retention, along with higher satisfaction and perceived preparedness (Biffi & Woodbury, 2018). Together these studies illustrate that dual-channel, interactive experiences foster deeper encoding and more durable memory traces than screen-centric exposure to text or slide decks. E-learning that merely streams visual and auditory input without interaction risks under-engaging the very pathways, sensorimotor, associative, affective—that make memories richly retrievable (Mayer, 2002).

Active vs. Passive Learning: Why It Matters for Memory

Robust long-term learning depends on active engagement. Questioning, explaining, arguing with peers, receiving immediate feedback, and solving novel problems recruit the prefrontal cortex and hippocampus in ways that passive exposure does not. By contrast, watching long recordings without interaction resembles film viewing: information flows in, but constructive processes, generating inferences, building mental models, integrating with prior knowledge are weaker. To make online education genuinely effective, courses must prompt reflection and production (notes, solutions, micro-essays, narrated explanations), interleave retrieval practice, and embed opportunities for transfer. When reading, the brain actively constructs situation models and simulates described events, engaging language networks, visual cortex, and memory systems; when merely viewing a video, cognitive work can be lighter unless design forces generative processing. Passive consumption is additionally vulnerable to digital distraction, which disrupts consolidation and increases susceptibility to forgetting (Gazzaley & Rosen, 2016).

Taken together, the picture is clear: while the biological machinery of memory does not change across modalities, the emotional, attentional, cognitive, and sensory conditions that surround online learning can either weaken or strengthen it. The decisive variable is design. Courses that engineer stable context, social presence, attention support, low extraneous load, and multimodal, interactive engagement give the hippocampus and neocortex the conditions they need to encode, consolidate, and re-elaborate knowledge. Under those conditions, e-learning can rival, and in some respects exceed, the affordances of traditional classrooms.

Emotional Involvement and Social Cognition in Online Learning

Emotional involvement is a powerful determinant of learning effectiveness because affective states shape what we notice, how deeply we encode, and how reliably we retrieve information later. Contemporary affective neuroscience shows that emotionally salient stimuli engage coordinated activity in the amygdala, which appraises significance and mobilizes arousal, and in the hippocampus, which binds perceptual, semantic, and contextual features into durable declarative memory traces (Tyng et al., 2017). The tighter the coupling between these systems, the greater the probability that experiences will be consolidated into long-term memory. This principle has straightforward educational implications: instruction that evokes authentic interest, curiosity, or a sense of personal relevance provides richer “emotional tags” for subsequent consolidation than neutral exposure to material, and thus supports more persistent learning gains. In online settings the challenge is to cultivate such engagement in the absence of the full spectrum of in-person social signals, while avoiding the counterproductive elevations in stress or anxiety that can narrow attention and impair performance.

The Limbic System, Emotion, and Learning Modalities in distance learning

Learning is simultaneously cognitive and neurobiological. Within the limbic system, the amygdala, hippocampus, and their reciprocal connections with the prefrontal cortex (PFC) constitute an affect-memory-control triad that shapes motivation, attention, and consolidation. Decades of work indicate that the amygdala tags events with affective value and modulates hippocampal plasticity; the hippocampus encodes and later reinstates richly contextualized memories; and the PFC exerts top-down regulation that supports goal maintenance, reappraisal of emotion, and strategic allocation of cognitive resources (LeDoux, 2000; McGaugh, 2004; Ochsner & Gross, 2005). In educational contexts this circuitry means that emotions are not mere by-products of instruction but active determinants of what students learn and remember (Immordino-Yang & Damasio, 2007). Appropriate activation of the amygdala can enhance attention and facilitate hippocampal encoding of emotionally significant academic content (Tyng et al., 2017), whereas sustained or excessive activation, e.g., due to stress, uncertainty, or evaluative threat, impairs working memory and undermines executive control (Pekrun, 2006; Pekrun et al., 2011). Because online environments can amplify both engagement and stressors, modality choice matters. In-person instruction typically supplies rich, synchronous non-verbal cues, gaze, posture, prosody that generate immediacy and shared affect, while digital platforms must compensate for thinner cues through intentional design that fosters motivation, social presence, and a sense of belonging.

The amygdala's role in prioritizing emotionally salient material explains why students more readily remember content that is framed through compelling narratives, real-world stakes, or personally meaningful applications. Adjacent to the amygdala, the hippocampus supports the formation of new declarative memories; its interaction with the amygdala strengthens encoding when material carries affective weight. Conversely, adversity and chronic stress, common when learners face technological hurdles, isolation, or high-stakes assessments, can disrupt hippocampal neurogenesis and plasticity, leading to poorer memory formation and retrieval (Lupien et al., 2007). The PFC adds the capacity to regulate these states, enabling learners to reframe anxiety, plan study strategies, suppress distractions, and persist with complex tasks. The functional unity of these systems underscores why effective instruction engages the whole learner—cognition entwined with emotion—rather than treating emotion as peripheral.

Emotion as a Moderator of Learning Outcomes

Emotions modulate every stage of learning. Positive states, curiosity, enjoyment, interest, are associated with greater intrinsic motivation, persistence in the face of challenge, and deeper engagement with content (Pekrun, 2006; Pekrun et al., 2011; Ryan & Deci, 2017). Such states facilitate broader attentional scope, more flexible cognitive control, and richer associative processing, which in turn support elaboration and integration of new knowledge. Positive affect also "tags" experiences for consolidation, increasing the likelihood that reactivation during sleep will strengthen relevant cortical representations (Immordino-Yang & Damasio, 2007). By contrast, negative states, anxiety, boredom, frustration, consume executive resources, constrict attentional breadth, and interfere with working memory, leading to more superficial processing and weaker consolidation (Pekrun et al., 2011; Tyng et al., 2017). The same emotion can also have inverted-U effects: moderate arousal may optimize vigilance and memory, whereas too little yields apathy and too much yields overload. The modality of instruction shapes these emotional dynamics. Online learning offers flexibility and access but also distinctive affective profiles. Reduced co-presence and spontaneous non-verbal signaling can attenuate social connection and accountability, raising the risk of disengagement or loneliness (De Felice et al., 2023). Greater demands on self-regulation—time management, self-monitoring, emotional control, shift burden onto the PFC; without sufficient scaffolding, this can culminate in fatigue, procrastination, and diminished ability to regulate negative emotions (Broadbent & Poon, 2015; Riedl, 2021; Faza & Lestari, 2025). Prolonged video-conferencing introduces "Zoom fatigue," driven by constrained non-verbal bandwidth, the cognitive effort of interpreting micro-cues on screens, persistent self-view, and reduced physical mobility; the result is increased stress and attentional depletion (Bailenson, 2021; Riedl, 2021). For some learners, the technical demands and perceived lack of immediate support heighten anxiety, which can directly impair hippocampal-dependent memory and PFC-mediated executive function, thereby depressing achievement (Lupien et al., 2007; Pekrun et al., 2011).

Challenges for the E-learning process

Within this broader picture several recurrent challenges emerge. First, reduced social presence and the possibility of isolation: the scarcity of spontaneous, multimodal non-verbal cues online can weaken the felt sense of being "with" others, which in turn diminishes motivation and belonging and may activate stress responses that hinder learning (De Felice et al., 2023; Broadbent & Poon, 2015; Faza & Lestari, 2025). Second, increased self-regulation demands: online modalities shift responsibility for pacing, monitoring, and emotion regulation from the external structure of classrooms onto the learner; where metacognitive skills are still developing, this shift increases cognitive load on the PFC and can culminate in emotional exhaustion (Broadbent & Poon, 2015; Riedl, 2021). Third, video-conferencing fatigue and cognitive overload: the intensity of screen-mediated interaction, reduced movement, and continuous self-presentation can elevate stress and deplete attentional resources (Bailenson, 2021). Fourth, heightened anxiety for some learners, triggered by technical uncertainty or constant on-screen visibility; anxiety in turn compromises hippocampal function and executive control (Lupien et al., 2007; Pekrun et al., 2011). Effective online design therefore aims not merely to deliver content but to engineer emotional climates that promote curiosity and calm focus while providing supports for self-regulation.

Dopamine and Reward Pathways in Distance Learning

Dopamine is a neuromodulator central to reward processing, reinforcement learning, and motivation. In educational contexts dopaminergic signaling shapes the anticipation of desired outcomes, the perceived salience of tasks, and the willingness to exert effort toward goals. Micro-rewards common in digital environments, notifications, badges, instant quiz feedback, streaks, rapid progress bars, can transiently boost engagement by capitalizing on prediction-error dynamics: when outcomes are slightly better than expected, phasic dopamine bursts reinforce the behaviors that preceded them (Schultz, 2016). These mechanisms explain why well-timed feedback and clear proximal goals can energize participation in online modules (Long & Masmanidis, 2025).

However, design that leans too heavily on frequent, low-effort rewards risks narrowing learners' motivational landscape. Overexposure to quick hits of reinforcement can bias attention toward bite-sized tasks and away from the slower, effortful activities required for deep learning, extended reading, complex problem-solving, and sustained writing. Over time this may recalibrate sensitivity to reward, making it harder to persist when gratification is delayed or feedback is infrequent. The pedagogical implication is not to eschew gamified elements or fast feedback, but to nest them within a macro-structure that cultivates tolerance for delay and values cumulative accomplishment: capstone tasks that integrate prior modules; reflective prompts that connect immediate wins to long-term mastery; and assessment designs that reward process, strategy use, and revision, not just correct endpoints.

Interbrain Synchrony in Synchronous Online Learning

Social neuroscience has identified interbrain synchrony, the temporal alignment of neural activity across individuals as a substrate of successful communication and joint action. Hyperscanning studies using dual EEG, fNIRS, or fMRI show that during narrative communication, speaker and listener brains become coupled, a phenomenon interpreted as linguistic alignment and the construction of shared situation models (Stephens, Silbert, & Hasson, 2010). Early work emphasized face-to-face interaction, but recent studies probe technologically mediated communication and its consequences for synchronous online learning.

Evidence suggests that current videoconferencing attenuates neural coupling compared with in-person exchange. Using fNIRS hyperscanning, Sato and Sato (2025) observed higher interbrain synchrony in right temporoparietal regions during live eye-contact tasks than during online interaction, consistent with reduced access to the subtle social cues that scaffold mutual understanding. Complementary results from dyadic problem-solving, creative, and socio-emotional tasks indicate that virtual settings yield fewer conversational turns and altered interbrain coherence patterns, changes associated with diminished prosocial behavior (Balters et al., 2023). In mother–child dyads, EEG hyperscanning revealed broad cross-brain connectivity across frontal and temporal regions during face-to-face interaction; when the same pairs communicated remotely, only a single significant cross-brain link remained, and key brain-behavior associations appeared exclusively in live settings, implying that remote channels limit the neural synchrony that underpins empathic engagement (Schwartz et al., 2022). At the same time, interbrain synchrony can arise without physical co-presence when collaboration is well structured. In remote cooperative gaming, Wikström et al. (2022) documented elevated neural coupling across alpha, beta, and gamma bands, with higher synchrony predicting better performance. Moderating factors such as transmission delay and jitter influence the degree of synchrony achievable at a distance (Lai, Li, Amano, & Rekimoto, 2025). The upshot for education is twofold: synchronous online learning should strive to reduce latency and enhance the fidelity of social cues; and tasks should be designed to promote shared attention, clear turn-taking, and joint goal construction—all of which support the neural alignment that facilitates coordination and learning.

The Cognitive Load of Digital Learning Environments

Cognitive Load Theory (CLT) distinguishes intrinsic load (imposed by the inherent complexity of the material), extraneous load (arising from suboptimal presentation), and germane load (the beneficial effort devoted to schema construction and automation) (Sweller, 1988). Digital platforms add distinctive sources of extraneous cognitive load (ECL): interface inconsistency, redundant or poorly sequenced media, unnecessary interactivity, and the friction of navigating multiple windows and tools. Recent work reviews how interactivity, immersion, and even "realistic" but disfluent elements in educational technology can inadvertently increase ECL when they are not tightly aligned to learning goals (Skulmowski & Xu, 2022). Çakiroğlu and Aksoy (2017) similarly show that coherence, redundancy, modality, and signaling cues within web-conferencing can raise or lower ECL; poor integration of these components impedes learning in synchronous online instruction. In asynchronous forums, learners report that task ambiguity and navigation demands siphon cognitive effort away from content—an example of ECL documented in an undergraduate online STEM course (Faulconer, Wood, & Bolch, 2022).

These findings do not imply that digital richness is always harmful; rather, they underscore the need to balance motivational affordances with cognitive efficiency. Mayer and Moreno (2003) articulated principles that remain highly relevant online: avoid redundancy by not presenting identical information simultaneously in multiple formats; keep related elements spatially contiguous; and present corresponding visual and verbal information in temporal contiguity. Beyond media micro-design, course-level frameworks such as the Quality Matters (QM) Higher Education Rubric codify practices that reduce ECL while supporting learner orientation and self-regulation. Standard 1.1 calls for a clear "getting started" pathway that explains how to find course components, minimizing the cognitive overhead of initial navigation. Standard 1.2 introduces the course's purpose and structure so learners can construct a coherent mental model from the outset. Standard 2.3 requires learning objectives to be clearly stated, learner-centered, and easy to locate, directing attention toward what matters. Standard 4.2 asks instructors to make explicit the alignment among materials, activities, and assessments, so students need not infer how a resource supports an assignment. Standard 6.1 emphasizes the purposeful selection of digital tools in line with objectives, avoiding the ECL that poorly integrated technologies impose. Finally, Standards 8.1, 8.2, and 8.6 address navigation, readability, and multimedia usability, respectively, ensuring that the course is easy to move through, visually legible, and technically smooth. Together, these design choices protect scarce working-memory resources, allowing germane load to be invested where it belongs, constructing and refining schemas that underpin durable learning.

Across these sections, a coherent design theme emerges. Emotion, social presence, reward, synchrony, and cognitive economy are not peripheral to online learning—they are the levers through which digital environments can either impair or amplify the neural processes that support understanding and memory. The next sections build on this foundation by specifying concrete design patterns that operationalize these principles at the level of activities, assessments, and platform configuration.

The E-learning Fatigue

E-learning fatigue denotes a pattern of mental, emotional, and bodily exhaustion that accumulates through prolonged engagement with digital platforms for study and assessment. More than ordinary tiredness, it reflects a convergence of cognitive overload, attenuated social cues, and restricted bodily movement that together erode motivation, self-regulation, and learning efficacy (Bailenson, 2021). Understanding this multifactorial syndrome is essential for the design of sustainable online pedagogy; what follows clarifies the construct, describes its manifestations, analyzes antecedents, and synthesizes empirical evidence on prevalence and impact. Within digital education, fatigue arises when the total demands of online participation, for example, sustained screen gaze, continual self-presentation on camera, rapid switching among applications, and constant micro-decisions about attention, exceed the learner's capacity to process, recover, and regulate. Tuğtekin (2023) characterizes this state as the point at which the influx of content and activity streamed through learning-management systems and videoconferencing outstrips information-processing resources, producing a sense of depletion that undermines performance and well-being.

The syndrome shows itself across intersecting domains; physically, learners report eye strain, headaches, musculoskeletal discomfort, and general malaise after long stationary sessions (Bonanomi et al., 2021). Cognitively, they describe reduced concentration, slower comprehension, and poorer retention as working memory is taxed by multitasking and interface management. Affective signs include irritability, frustration, anxiety, loneliness, and a decline in resilience, especially when social belonging cues are attenuated (Mosleh et al., 2022). Together these dimensions feed a negative loop in which exhaustion lowers motivation, which in turn diminishes engagement and learning outcomes.

Several recurring conditions elevate risk and severity:

• Prolonged Screen Time and Insufficient Breaks. Continuous exposure to screens with minimal movement or visual relief drives ocular strain and general fatigue (Rehman et al., 2023). Micro-pauses and posture changes are often neglected during back-to-back online sessions.

• Cognitive Overload. In digital settings learners must master content while simultaneously navigating interfaces, juggling windows, and decoding constrained non-verbal cues. Numerous studies, including Widyanti et al. (2020), show that subjective mental workload is higher online than in face-to-face learning.

• "Zoom Fatigue" and Non-verbal Overload. Videoconferencing imposes distinct burdens: intense near-field eye contact, the cognitive effort of interpreting degraded non-verbal signals, constant self-monitoring from the self-view mirror, and reduced bodily mobility. Bailenson (2021) identifies these four factors as core drivers of a uniquely draining interaction style.

• Diminished Sensory Richness and Social Isolation. The absence of rich, co-present multisensory cues and spontaneous peer interactions increases loneliness and weakens social motivation, compounding psychological stress (Mosleh et al., 2022).

Surveys and observational work during and after the COVID-19 pivot document the breadth and impact of digital fatigue. Reed (2022) reports that students in communication sciences and disorders who scored higher on e-learning fatigue also reported greater difficulties in learning, mental health, and attitudes toward online study, with concerns about downstream professional readiness. Romero-Rodríguez et al. (2023) identify medium-to-high prevalence among university students, with higher risk associated with female gender, arts/humanities majors, and extensive device use. A meta-analysis by Beyea et al. (2025) synthesizing 38 quantitative studies across 56 predictors finds psychological variables most predictive of videoconference fatigue. Overall, a consistent, medium-sized connection was found between people's psychological concerns and variables and the increase in their fatigue during online meetings: essentially, the higher the psychological stress, the greater the video call exhaustion. Among all the specific elements analyzed, the single factor that showed the strongest relationship with fatigue was the feeling of "being trapped." This suggests that the perception of being unable to move freely, break eye contact, or turn off the camera is a particularly potent contributor to burnout and weariness. In the workplace domain, Nesher and Wehrt (2022) tracked 988 meetings and confirmed that video conferences are more exhausting than other meeting types; interviews in a companion study implicated emotional factors—loss, nostalgia, and reduced meaning, as salient contributors, while better facilitation and meeting design emerged as mitigations. Complementary research highlights structural barriers: Serhan (2020) documents limited technological readiness, access constraints, and the need for extra support during rapid transitions to online formats.

Synthesis and Design Implications. Psychologically, fatigue is amplified by the constant self-regulation demands of online study: pacing one's time, resisting interruptions, and sustaining effort without external structure. Pedagogically, the solution space includes workload pacing, protected recovery intervals, explicit social-belonging cues, and interaction patterns that lower self-presentation strain (e.g., camera-optional segments, audio-only reflection, movement prompts). Thoughtful scheduling and interface simplification reduce the total "cost" of participation and help learners recover cognitive and affective resources needed for deep work.

Neuroplasticity and Adaptive Learning Technologies

Neuroplasticity, that shortly can be described as the brain's capacity to alter synaptic strength and network topology through experience, has a dual impact in digital education. Repeated interaction with networked media can sharpen certain functions while blunting others, depending on task ecology and intensity (Dayan & Cohen 2011). Loh and Kanai (2016) report associations between high internet/media use and structural as well as functional differences in regions implicated in attentional control and visual processing (e.g., prefrontal cortex, anterior cingulate). Such adaptations may support multitasking and visuospatial scanning yet coincide with reduced capacity for sustained, reflective attention when environments are high in novelty, salience, and interruption. Yet neuroplasticity is the fundamental biological basis of learning (Rivoltella , 2012).

Converging reviews underscore this trade-off; Firth et al. (2019), in fact, synthesize evidence that heavy digital multitasking is linked to decrements in attention and memory processes and to disruptions in social-cognitive functioning. Complex multimedia, text, animation, sound, encourage task switching and taxes working memory, impairing consolidation when design exceeds cognitive capacity. Neuroimaging adds convergent signals: Takeuchi et al. (2018) report that extensive internet use correlates with lower gray-matter volume in regions subserving language, memory, and executive control, suggesting a possible cost to skills crucial for academic learning, even as fluid, rapid visual skills may be reinforced.

Harnessing Plasticity by Design implies that the same plasticity can be steered toward beneficial outcomes when instruction respects cognitive architecture. Mayer (2009) shows that multimedia learning is most effective when extraneous load is minimized and materials align with learners' mental models. Design that reduces split attention, leverages signaling, and sequences modalities thoughtfully promotes deep processing and long-term retention.

Adaptive and AI-Mediated Personalization therefore, is fundamental strategy. Utilizing Artificial Intelligence (AI) systems to modify the learning experience, content difficulty, sequence, and feedback in real-time based on the individual learner's needs, performance, and cognitive states. A systematic review by Halkiopoulos and Gkintoni (2024) finds that AI-supported personalization can improve performance, engagement, and motivation, while also warning of fairness, bias, and transparency risks that require rigorous evaluation and ethical oversight. Likewise, Shiwlani, Hasan, and Kumar (2024) survey adaptive systems and neurofeedback interfaces that enhance brain-based strategies but note challenges in cost, data privacy, and algorithmic bias. The design imperative is dual: use adaptive models to meet learners where they are, and embed safeguards to ensure equity and trust.

Temporal Dynamics and Spacing. Plasticity is also time-sensitive. The spacing effect, superior retention from distributed practice over massed study, reflects consolidation dynamics at the synaptic and systems levels (Smolen et al., 2016). Digital platforms can operationalize spacing by scheduling revisits, surfacing lagging items, and prompting brief, varied retrievals across days. When coupled with workload transparency and friction-reducing interfaces, such systems channel plasticity toward durable learning rather than superficial familiarity.

Neurobiology of Attention in Digital Learning Contexts

Attention, to employ an effective metaphor, can justly be considered the threshold, the very "front door" for every learning process. In contemporary online environments, this vital cognitive function confronts a peculiar challenge: it must filter, prioritize, and crucially, maintain sustained focus against an unusually dense and dynamic background of competing signals. Classical theoretical accounts of selective attention initially likened it to a “spotlight”that enhances the processing of information at a specific spatial or conceptual location; clinical disorders such as neglect and extinction offered substantial clinical plausibility to this foundational model.Building upon this, Treisman and Gelade’s Feature Integration Theory (1980) further argued that focal attention is an indispensable requirement for binding disparate attributes, such as color, shape, and motion, into coherent, perceptible objects. Subsequent scholarly work, however, has reframed this crucial process not merely as a static spotlight, but rather as a dynamic competition among stimuli for the brain’s limited representational resources, a contest constantly modulated both by bottom-up salience and by top-down cognitive goals (Desimone & Duncan, 1995). This tension echoes broader debates on the interplay between automatic and controlled processing, a fundamental issue in cognitive psychology.

The Architecture of Attention and the Digital Strain

It is possible to conceptualize attention as a complex network of interdependent systems. In this highly influential view, Posner and Petersen (1989) distinguished three functional interacting systems: (1) the Alerting Network, which is responsible for sustained vigilance (a neurobiological system engaging the *locus coeruleus–norepinephrine* and right frontoparietal regions); (2) the Orienting Network, which selects inputs based on location and features (localized in the parietal cortex, superior colliculus, and frontal eye fields); and, finally, (3) the Executive Control Network, which is dedicated to conflict monitoring and decision-making processes (primarily utilizing the anterior cingulate cortex and the dorsolateral prefrontal cortex).Proceeding from this tripartite architecture, one must deduce that digital learning contexts strain each of these systems in significantly different ways than co-present classrooms. Examining how these three networks combine and operate during online activities reveals the specific neurocognitive challenges posed by e-learning environments, demanding a careful consideration of the neurodidactic ethos inherent in platform design.

- Alerting / Sustained Attention: Within the screen-based environment, the conspicuous absence of ambient classroom cues, coupled with a constant influx of notifications and parallel application streams, inherently tends to fragment vigilance. A 45-minute webcast, for instance, invites intermittent phone checking or tab-surfing behavior, unless the instructional design intentionally embeds interactive checkpoints and essential recovery micro-breaks. In stark contrast, in-person settings implicitly recruit social monitoring and the stabilizing power of physical co-presence to maintain the alerted state.
- Orienting / Selective Attention: E-learning frequently necessitates rapid and complex shifts among various modalities, including video, text, PDFs, discussion threads, and embedded quizzes. This proliferation of separated information streams (the *split streams*) encourages superficial sampling and surface-level processing, unless the digital interfaces meticulously collocate related elements and establish a deliberate, coherent sequencing of modalities. In traditional classrooms, a singular, central stream the teacher's voice, the board, gestures guides selection with considerably less cognitive fragmentation (Corbetta & Shulman, 2002).
- Executive Control: Online study demands a profoundly high degree of self-regulation, unassisted by external pacing: resisting the pull of

social media, establishing task priority, and managing multiple active windows are all burdens that fall entirely upon the student. Consequently, the executive control network is taxed more intensely; without appropriate cognitive scaffolds, it is trivially easy to succumb to unproductive task-switching and delay. In contrast, in-person instruction offloads a portion of this control burden, externalizing it to teacher-established pacing and shared community norms (Botvinick et al., 2001).

Cognitive Cost of Multitasking: Effort to Suppress Distractors

The reliance on frequent media multitasking, the cross-stream switching behavior, compromises sustained attention capacity and severely elevates the control effort required to suppress irrelevant inputs. Consistent with this observation, the empirical work of Ophir, Nass, and Wagner (2009) compellingly demonstrated that heavy media multitaskers exhibit poorer filtering of distractors and diminished cognitive control relative to light multitaskers, a significant liability when coursework necessitates extended and deep reasoning.Beyond the intrinsic complexity of the content (*intrinsic load*), which is unavoidable, several avoidable features of digital instructional design tend to inflate the extraneous cognitive load. This raises a crucial methodological point, as sources of extraneous load divert scarce cognitive resources away from germane processing and, predictably, impair comprehension (Sweller, Ayres, & Kalyuga, 2011, pp. 57–68).

- Poor Interface Design: Cluttered pages, inconsistent navigation, and gratuitous aesthetic noise compel the learner to expend scarce cognitive resources on wayfinding and interface management, rather than on semantic understanding.
- The Split-Attention Effect: When related elements (e.g., explanatory text, diagrams, and narration) are spatially or temporally separated, such as a video in one window and the relevant figure in another—the learner is cognitively forced to mentally integrate them, a

process which substantially increases cognitive load and, predictably, depresses comprehension (Mayer & Moreno, 2003).

- The Redundancy Effect: The simultaneous presentation of identical information across multiple formats (e.g., on-screen text coupled with verbatim narration and duplicate graphics) does not reinforce learning; rather, it paradoxically hinders it by overtaxing sensory and cognitive channels (Clark & Mayer, 2016).
- Insufficient Scaffolding: Materials that lack a clear organizational hierarchy, adequate visual signaling, or guided pathways shift the intellectual burden of organization onto the learner, thereby inflating unnecessary effort (*extraneous effort*) (Sweller, Ayres, & Kalyuga, 2011, pp. 57–68).

Implications and Design Perspectives

The implications of this neurobiological analysis for digital pedagogy are unambiguous. Effective digital course design must rigorously aim to reduce extraneous load and actively support all three attentional networks. This goal is achieved through targeted strategies, including: (a) simplifying navigation and collocating related elements; (b) regulating instructional pace via interactive prompts, retrieval practice, and strategic micro-breaks; (c) minimizing redundancy while ensuring the functional coordination of modalities; and (d) externalizing executive control through mechanisms like checklists, timers, and visible progress indicators. Such conscientious design restores cognitive bandwidth, allowing resources to be fully devoted to germane processing and genuine learning. This pattern, which has been consistently developed across Sections 7–9, demonstrates that fatigue, neuroplasticity, and attention are, in fact, intimately intertwined. Platforms that respectfully acknowledge and honor human cognitive limits, by pacing effort, strategically shaping reward, balancing modalities, and scaffolding control, successfully convert digital abundance from a potential liability into a definitive cognitive asset. The subsequent chapter will operationalize these crucial principles in concrete activity designs and formal assessment schemas.

The Pervasive Threat of Digital Distractions

Beyond design-induced extraneous load, contemporary digital ecosystems are, by construction, high-interruption environments. Constant alerts from email, social media, messaging apps, cloud drives, and parallel platforms are engineered to capture attention and trigger immediate re-orientation. These notifications operate as powerful attentional lures that fragment work into micro-episodes and force frequent task switching (Lepp et al., 2019). Each interruption carries a measurable re-engagement cost: the learner must disengage from the focal task, encode the state of work for later resumption, evaluate the salience of the alert, and then reconstruct the original train of thought. Even when an alert is ignored, inhibition itself expends control resources, making subsequent lapses more likely.

Low-friction access to alternative content further amplifies distraction. Irrelevant streams, social feeds, short-form video, breaking news, shopping and messaging, are always one click away. The minimal barrier to entry makes diversion the default and sustained focus the exception. In this context, a cultural norm of “multitasking” has taken root. Yet the literature is clear: what appears as parallel processing for complex cognition is typically rapid serial task switching that increases error rates, slows throughput, and yields shallower encoding (Blenker & Parsons, 2018). For learning, the consequence is predictable: knowledge becomes brittle because initial encoding is thin and rehearsal cycles are truncated.

Distraction is not only external and event-driven; it is also internal and expectation-driven. Anticipatory checkingcom, pulsively monitoring for replies or updates, creates a background itch that degrades working memory even in the absence of explicit alerts. This phenomenon is intensified by variable-ratio reinforcement schedules used by many platforms: unpredictable rewards (likes, messages, new content) create “just in case” attentional probes that splinter study time into discontinuous fragments. In aggregate, these forces generate a hostile environment for the sustained, effortful cognition that higher education requires.

Design responses therefore must operate at multiple levels. At the device level, learners benefit from notification triage (batch delivery, do-not-disturb windows), app-level focus timers, and single-purpose study spaces without parallel feeds. At the course level, instructors can schedule predictable interaction windows, collocate related materials, and use platform-native pacing (e.g., progress bars, milestone checkpoints) so that attention is channeled rather than dissipated. At the assessment level, tasks that reward depth, extended synthesis, cumulative projects, retrieval-practice schedules, counterbalance the shallow incentives of always-on media while still leveraging timely, formative feedback to maintain engagement.

The Cognitive Cost of Suppressing Irrelevant Information

In digital study, learners carry an additional, often invisible burden: the continuous effort required to suppress irrelevant stimuli. Classic work on inhibitory control shows that resisting distraction consumes working-memory capacity and degrades performance on concurrent tasks (Hasher & Zacks, 1988). Neuroscientific evidence clarifies the mechanism: top-down control networks must stay active to gate inputs, bias competition toward task-relevant representations, and tamp down prepotent responses (Gazzaley & Nobre, 2012). Suppression is not the absence of processing; it is processing of a different kind, and it is metabolically and cognitively expensive.

Within e-learning interfaces, suppression demands are ubiquitous. Pop-ups, animated badges, flashing icons, chat previews, and even visually dense page furniture are detected pre-attentively, then evaluated and inhibited. Each such cycle draws on the same control resources needed for comprehension, organization, and integration of core material. Skulmowski and Xu (2022) situate these costs within extraneous cognitive load: filtering peripheral interface elements is not a trivial nuisance but a competitive drain on limited capacity, especially when learners must coordinate reading, note-taking, hyperlink navigation, and media controls in parallel.

Over time, repeated suppression can shape attentional habits in maladaptive ways. Learners habituated to cluttered or alert-rich environments may adopt a scanning style marked by continual vigilance for new stimuli and rapid task switching. This style is poorly matched to academic tasks that require building and maintaining a complex mental model over extended intervals. Indeed, research in educational technology suggests that attention mismanagement in online contexts fosters shallow processing and undermines complex problem-solving (Roda & Nabeth, 2005). The apparent ease of digital engagement thus conceals substantial inhibitory costs that quietly erode the capacity for deep work.

Design implications are straightforward. Clean, uncluttered interfaces reduce baseline suppression demands; spatial and temporal contiguity minimize the need to integrate separated streams; signaling highlights what is relevant and de-emphasizes what is not. Time-structured activities (focused sprints, retrieval intervals, reflection windows) provide exogenous scaffolds that support endogenous control. In short, effective courses are not only efficient in information delivery; they are protective of learners' control resources.

Attention and Visual Selection in Digital Learning

Attention in online study is not a single "spotlight" but an emergent property of distributed networks coordinating selection, maintenance, and conflict resolution. The dorsal frontoparietal system (intraparietal sulcus, superior frontal cortex) supports goal-directed, top-down selection, while the ventral system (temporoparietal junction, inferior frontal cortex, especially right-lateralized) acts as a "circuit breaker" that reorients focus toward salient, unexpected events (Corbetta & Shulman, 2002). Digital interfaces recruit both: top-down control to follow a lecture, solve a problem set, or write an essay; bottom-up capture when notifications, animations, or layout changes demand re-evaluation. Good instructional design tips the competitive balance toward top-down goals without rendering the interface inert.

Classical visual cognition adds a complementary lens. Treisman and Gelade's (1980) Feature Integration Theory proposes that basic features like color, orientation, motion, are processed in parallel prior to focused attention, which then binds them into objects. Practically, this means that digital materials should present coherent, discriminable visual units so that pre-attentive processing supports, rather than fights, comprehension. Cluttered screens, inconsistent iconography, and poorly grouped elements force the learner to spend scarce attention on binding and search rather than on meaning.

Two design levers are particularly well supported. First, signaling and visual guidance: eye-tracking studies show that dynamic cues (arrows, highlights, transient zooms) in instructional video help learners navigate complex representations and reduce extraneous load (Rodemer et al., 2022). Second, temporal pacing: guiding attention with segmenting and brief time-based prompts improves maintenance of focus during animations and dense multimedia (De Koning et al., 2007). Both levers work by externalizing part of the control function that the frontoparietal network would otherwise supply internally.

From a large-scale network perspective, sustained attention depends on the frontoparietal control network (Dosenbach et al., 2008), which coordinates working memory and task set maintenance. Frequent reorientations impose "switching costs": every shift requires re-engaging control, reloading task context, and clearing interference (Monsell, 2003). Media multitasking research confirms the behavioral signature of this strain. Moisala et al. (2016) show that habitual multitaskers display greater distractibility and heightened recruitment of control regions, reflecting compensatory effort rather than superior capacity. In instructional terms, minimizing unnecessary competition among stimuli and stabilizing the task context are prerequisites for deep comprehension and retention.

Social Neuroscience and Virtual Learning Communities

Nowadays in pedagogy, the idea that Humans learn in and through relationships is a widespread accepted and common concept. Social neuroscience identifies a core "social brain" network, including medial prefrontal cortex (mPFC), temporoparietal junction (TPJ), superior temporal sulcus (STS), anterior cingulate cortex (ACC), and insula, that supports mentalizing, empathy, and the parsing of socio-emotional cues (Lieberman, 2007; Mars, Neubert, & Rushworth, 2012). Crucially, these systems are not offline in virtual settings. When a learner reads targeted feedback, follows a recorded explanation, or participates in a discussion forum, they continue to infer intentions, weigh credibility, and align with perceived norms; the same neural resources scaffold understanding and motivation.

Socio-emotional cues in online teaching are carried primarily by voice, prosody, facial expression, gaze, and gesture, signals decoded by STS and adjacent temporal regions. Warm tone, expressive prosody, and responsive micro-affirmations increase trust and persistence; flat delivery dampens engagement. Collaborative tools activate ACC and insula as students negotiate meaning, manage disagreement, and regulate affect in group work (Cui, Lockee, & Meng, 2012). In short, effective digital pedagogy is explicitly social: it engineers opportunities for recognition, reciprocity, and shared purpose.

A growing line of evidence has been examining neural coupling across learners and instructors. Using hyperscanning, Dikker et al. (2017) found that classroom engagement correlates with inter-brain synchrony; more aligned neural dynamics predict better learning. While synchrony is typically stronger in co-present contexts, synchronous video can approximate some of these effects better than asynchronous text alone, highlighting the value of immediacy and rich cues for online pedagogy.

Observational learning adds a further mechanism. The mirror-neuron system, neurons active during both action execution and observation, supports imitation and skill acquisition (Rizzolatti & Craighero, 2004). In online formats, clear demonstrations (e.g., visible hand movements, problem-solving steps, instrument handling) can recruit this system and enhance learning, provided that camera angles, pacing, and visual clarity are thoughtfully designed.

Immersion technologies push social affordances further. Bailenson (2018) argues that virtual reality's power lies in presence, the felt sense of "being there." Systematic reviews report that collaborative VR can increase inter-brain synchrony in frontal and temporoparietal regions during joint tasks (Czeszumski et al., 2022), and immersive science lessons can yield greater emotional engagement and longer-term retention than desktop formats, even when intrinsic load rises (Liu et al., 2022). The design challenge is to harness these benefits without overwhelming cognitive resources: social presence must amplify, not compete with, core content. Virtual Reality (VR) and the Metaverse are indeed the new frontiers of e-learning. However, due to the lack of sufficient efficacy studies and their rare deployment in distance learning, we are not deepening this topic further within the scope of this research.

Practical implications follow anyway from the above cited literature; foster social presence through consistent instructor voice and timely feedback; structure collaboration with clear roles and norms; schedule synchronous touchpoints for alignment; and use video deliberately (camera framing, gesture visibility) to expose the informative aspects of performance. Where appropriate, add lightweight embodied cues (shared pointing, gaze indicators) and minimize competing on-screen elements during critical explanations. Effective virtual communities are thus built, not assumed: when design recruits mentalizing networks, supports empathy, and scaffolds coordination, online learning becomes both socially meaningful and cognitively robust.

Stress Response Systems and Online Learning Environments

Online learning introduces a distinctive constellation of stressors, technical instability, attenuated social cues, blurred home–school boundaries, and a perpetual sense of “being on” that interact with neurobiological stress systems in ways that can either sharpen or degrade learning. At the core are two coordinated pathways: the sympathetic–adrenomedullary (SAM) system, which rapidly mobilizes arousal via catecholamines, and the slower hypothalamic–pituitary–adrenal (HPA) axis, which releases glucocorticoids, chiefly cortisol. Together these systems modulate attention, motivation, and memory formation, producing the classic inverted-U relation between arousal and performance: modest, time-limited stress can enhance encoding and consolidation, whereas chronic or excessive stress erodes them (Vogel, 2016).

Cortisol’s role is especially complex. Brief, moderate elevations bind to receptors in the hippocampus and amygdala, heightening vigilance, sharpening attentional selection, and facilitating synaptic plasticity during consolidation. When elevations become frequent or prolonged, however, glucocorticoid exposure contributes to dendritic remodeling and impaired neurogenesis in hippocampal circuits, with downstream costs to declarative memory and flexible cognition (McEwen et al., 2016). In online contexts, stressors are often both cognitive (rapid platform switching, ambiguous expectations) and psychosocial (isolation, reduced immediacy with instructors and peers), increasing the probability that transient challenge evolves into allostatic load.

Evidence from the COVID-19 shift to remote instruction illustrates these dynamics. Quintiliani et al. (2022) reported that Italian university students showed elevated physiological stress markers during pandemic e-learning, and that higher stress was associated with poorer learning and well-being. Technical unreliability, reduced structure, and diminished social support amplified uncertainty and vigilance, shifting students away from the adaptive peak of the stress–performance curve. These findings align with broader psychophysiological literature showing that chronic unpredictability and loss of control are among the most potent drivers of HPA activation and fatigue.

Design implications follow directly. Online courses should buffer uncontrollable stressors (e.g., by offering redundant access paths, clear remediation for technical failures, and predictable weekly rhythms) and transform challenge into manageable, time-bounded effort (e.g., well-scaffolded tasks with transparent criteria, rapid formative feedback, and opportunities for short recovery periods). When stress is right-sized and time-limited, arousal can energize attention and memory; when it is chronic and unstructured, it undermines both.

Implications for E-Learning

Translating neurocognitive evidence into design yields a practical set of guidelines for Italian higher education which will be more deeply exposed in the last chapter. First, instructors must manage cognitive load within design and prectice. Working memory is easily overrun when materials are cluttered, redundant, or poorly sequenced. Segment complex topics into digestible units; strip away non-essential audio or visuals; pair complementary modalities rather than duplicating the same information; and pre-train key terms and notations so that intrinsic load is reduced when students encounter advanced material (Sweller, Ayres, & Kalyuga, 2011; Mayer, 2014). A second, crucial consideration is the intentional management of attention. Even high-quality, well-designed content ultimately fails if the learner's focus collapses. It becomes paramount, therefore, to favor uncluttered interfaces and to ensure the collocation of related elements, thereby actively mitigating the pervasive risk of split attention.

The learning experience should be effectively paced through the integration of natural pauses, interactive prompts, and brief retrieval checks; these tactics function specifically to reset vigilance without derailing the cognitive flow. Furthermore, course design should actively foster deliberate focus strategies in students, such as notification batching or timed study sprints, allowing platform structure and student habits to work in tandem towards common learning goals (Zimmerman, 2002).

Third strategy, instructors and designers must cultivate social presence. Humans learn in communities; belonging and dialogue recruit reward and mentalizing systems that sustain motivation. Synchronous discussions, small-group collaboration, peer feedback, and regular instructor touchpoints foster the felt sense of a shared intellectual space. This aligns with Italian academic traditions that prize communal bonds and discourse, and with research linking social presence to engagement and achievement (Cui, Lockee, & Meng, 2012; Dikker et al., 2017; Bailenson, 2018).

Fourth, we must support memory consolidation. Create distinctive "virtual places" for course units to provide contextual retrieval cues; schedule spaced revisits; use low-stakes, frequent retrieval to stabilize traces; and offer multiple representational formats to deepen encoding. Spacing and retrieval are not conveniences but neurobiologically grounded levers for durable learning (Cepeda et al., 2006).

Last but not least strategy would consist on integrating bio-behavioral foundations. Stress management, circadian alignment, and sleep hygiene shape the yield of every study hour. Instructors should: 1)embed short stress-reduction practices within coursework, 2) provide flexible scheduling that accommodates chronotype; and . 3) educate learners about light exposure, device use, and routines that protect sleep. We must treat learners as whole, embodied systems, cognitive, attentional, social, and biological, and design accordingly (Preckel et al., 2011; Cain & Gradisar, 2010).

Sleep, Circadian Rhythms, and Digital Learning

Sleep is not passive downtime; it is an active biological program for stabilizing and reorganizing memory, by consequence we must take into account that evening exposure to blue-enriched light from phones and laptops suppresses pineal melatonin, delays circadian phase, and degrades subsequent sleep quality (Gooley et al., 2011). Experimental work shows that using light-emitting devices at night delays endogenous timing, reduces slow-wave sleep, and impairs next-day alertness and cognition (Chang et al., 2015). The consequences are direct: attention, working memory, and the capacity to encode new material all decline with curtailed or mistimed sleep (Durmer & Dinges, 2005; Lo, Ong, Leong, Gooley, & Chee, 2016).

At the neural level, hippocampal–cortical dialogue during slow-wave sleep replays recent experience, gradually embedding fragile traces into distributed neocortical networks (Wilson & McNaughton, 1994; Ji & Wilson, 2007). Systems consolidation transforms short-term, index-like representations into durable knowledge schemas (Frankland & Bontempi, 2005; Born et al., 2006). When sleep is fragmented or delayed, replay is disrupted, consolidation weakens, and learning gains shrink even if study time remains constant (Stickgold, 2005).

For e-learning design, sleep hygiene is therefore central, not peripheral. Educators can mitigate circadian disruption by encouraging earlier content engagement, offering downloadable materials for offline evening review, recommending blue-light filtering, and nudging students toward tech-free wind-down routines. Flexible pacing that avoids late-night deadlines protects the biological machinery upon which durable learning depends.

Circadian Alignment in E-Learning: Sleep, Chronotype, and Cognitive Performance Compared to Traditional Teaching

A distinctive strength of asynchronous e-learning is its potential to align with individual chronotypes. Adolescents and young adults tend toward eveningness; early schedules common in traditional schooling often collide with endogenous melatonin rhythms. Natural experiments during the COVID-19 period revealed that when schedules shift later, students sleep longer and report less daytime sleepiness and anxiety (Beattie et al., 2022). Analyses of learning-management-system logs indicate that misalignment, "social jetlag," where activity patterns diverge from institutional timing, is associated with lower grades (Smarr et al., 2023).

Performance varies by time of day as a function of chronotype: morning types perform better in early assessments, evening types in later sessions, even with similar total sleep (Lo et al., 2016). Irregular schedules delay circadian phase and impair performance independent of sleep quantity (Phillips et al., 2017). At the neurobiological level, chronic misalignment hampers synaptic plasticity, reduces hippocampal neurogenesis, and interferes with epigenetic programs essential for memory (Fonken & Nelson, 2014). Combined with melatonin suppression from late-night screens, conventional early schedules can erode the very systems that support learning.

Design implications are practical and actionable. Use asynchronous lectures and flexible deadlines to let students work at biologically optimal times; when synchronous meetings are necessary, schedule late morning or afternoon sessions to reduce disadvantage for evening chronotypes. Leverage LMS analytics to encourage regular, rhythmic engagement rather than sporadic, late-night bursts. Educate students about light, sleep timing, and routines that stabilize circadian phase. The point is not convenience but neuro-educational equity: aligning coursework with temporal biology yields better cognition and well-being.

The Visual Advantage of Online Learning

Leveraging the brain's visual processing for enhanced engagement, self-awareness, and learning outcomes in digital environments is predicated on the anatomical reality that vision dominates the human cortex: roughly a third of the cerebral mantle is, in fact, devoted to visual processing (Zeki, 1993). Furthermore, the robust findings from Dual-Coding Theory and the picture-superiority effect consistently demonstrate that pairing imagery with verbal information produces richer, more durable memory traces than words alone (Paivio, 1986; Nelson, Reed, & Walling, 1976). Online platforms can therefore achieve significantly more than merely substituting for traditional lectures: they possess the capacity to embed video, dynamic graphics, and even live self-view, thereby creating layers of rich feedback that effectively foster attention, self-awareness, and crucial metacognitive regulation.

The theoretical foundations are clear. Cognitive Theory of Multimedia Learning specifies how coordinated visual and auditory channels support selection, organization, and integration (Mayer, 2001; Mayer & Moreno, 2002). Metacognition, planning, monitoring, and evaluating one's learning, is strengthened by tools for pausing, annotating, replaying, and reflecting (Flavell, 1979; Zimmerman, 2000). Empirical work shows that video annotation promotes reflection and satisfaction (Rich & Hannafin, 2009), while pause-and-annotate features boost performance in secondary education (Yoon et al., 2021). At group scale, synchronized gaze and neural signals correlate with attention in video instruction (Dmochowski et al., 2014; Madsen et al., 2020); instructor on-screen presence enhances attention and retention via social cueing (Fiorella & Mayer, 2018); and peer gaze alignment predicts comprehension (Richardson & Dale, 2005).

Designers of online courses should therefore integrate clear visuals with narration, maintain a strategic on-screen teaching presence, and provide reflection tools (self-view, annotation, prompts). Peer-oriented cues, aggregated indicators of shared attention, can simulate collaborative immediacy. Caution remains essential: excessive or poorly aligned media can overload working memory (Sweller, 1988; Mayer & Moreno, 2002). The visual advantage emerges only when distraction is minimized and visuals are harnessed to focus, not fracture, attention.

Psychological Advantages of E-Learning

Flexibility is the signature advantage of digital study. Self-paced access to materials and a wider resource ecology can reduce performance anxiety for learners who thrive under autonomy. Perceived control enhances intrinsic motivation and engagement (Ryan & Deci, 2017; Pekrun, 2006). For students with social anxiety, online contexts may lower fear responses linked to real-time social evaluation, freeing cognitive resources for learning. With careful design, discussion boards, collaborative documents, and simulations provide alternative routes to socio-emotional engagement that accommodate diverse needs (Ifenthaler, 2023). Nevertheless, the affordances of physical classrooms are consequential: immediate, multi-layered feedback through eye contact, prosody, gesture, and shared rituals fosters social presence and immediacy, which in turn support learning (Witt, Wheeless, & Allen, 2004). Shared emotional experiences in group activities tag memories and sustain motivation (Immordino-Yang & Damasio, 2007). Structured routines reduce uncertainty and cognitive load. The challenge for e-learning is to reproduce these benefits, through instructor presence, synchronous touchpoints, and, where suitable, embodied technologies such as VR, while preserving the flexibility and accessibility that make digital formats attractive.

Implications for Instructional Design

Understanding the interplay between emotion, social presence, and cognition underscores that effective instruction is the product of deliberate choices at the level of climate, structure, pacing, and representation. In face-to-face classrooms, the instructional priority is to cultivate a climate that invites participation and makes use of the immediacy available in co-present settings: frequent eye contact, responsive prosody, and reciprocal turn-taking communicate care and competence and, in doing so, increase motivation while positively tagging experiences for consolidation. That climate is reinforced by tasks that carry authentic stakes, narrative framing that positions content within real problems, and opportunities for students to explain and test ideas publicly. Instructors can heighten emotional resonance without theatricality by building short, situated case narratives, using contrasting examples that surface misconceptions, and inviting students to generate analogies from their own contexts. These practices recruit affective systems that support attention and memory while preserving rigor and precision.

Online education demands design that compensates for the thinner bandwidth of cues while exploiting uniquely digital affordances. The evidence is convergent: building social presence is central to engagement and achievement. In middle-school settings, Gao, Gao, and Liu (2024) show that learner–learner and learner–instructor interaction predicts learning efficiency through the mediating roles of perceived social presence and engagement; similarly, Xia, Jia, and colleagues (2024) report that lectures deliberately engineered for social presence, clear instructor visibility, conversational tone, audience acknowledgment, and opportunities for brief synchronous interaction, produce stronger academic performance than otherwise comparable content. These results translate directly into design moves: maintain a recognizable instructor voice across media; use consistent on-screen framing that shows face and gesture when explaining difficult points; interleave brief temperature-checks and micro-prompts to spur participation; and open predictable windows for office hours and peer discussion so that availability feels reliable rather than sporadic.

Because autonomy is higher online, explicit support for self-regulation becomes a first-order requirement rather than a nice-to-have. A recent systematic review by Simón-Grábalos et al. (2025) finds that instruction in goal setting, progress monitoring, and reflective practice increases persistence and academic success in digital courses; aligned findings in continuing education show that self-regulated learning strategies materially affect outcomes (Hemmler et al., 2024). In practical terms, course shells should surface an at-a-glance roadmap with dated milestones, provide checklists for each module, embed brief planning prompts ("What will you do first? What might interrupt you?"), and include periodic progress reviews connected to low-stakes retrieval practice. These scaffolds externalize executive control, freeing cognitive resources for learning and reducing the hidden costs of constant self-management.

Emotional well-being and cognitive economy are jointly served by careful load management and meaningful learner choice. Multimedia should be varied but disciplined: segment complex explanations; pair modalities to complement rather than duplicate; remove decorative but irrelevant elements; and align all media to a small set of explicit learning objectives. Reducing extraneous load protects working memory, while modest choice, such as selecting among equivalent problem sets, choosing a case context, or timing an assessment within a defined window—supports autonomy and taps reward pathways associated with agency. Timely, constructive feedback then closes the loop: short, specific, task-focused responses delivered close to performance improve calibration and sustain effort more effectively than infrequent, global comments. Interactive elements can be used not to entertain but to sustain curiosity and active processing (De Jong, 2010). Reflective practice should not be relegated to end-of-course essays; brief metacognitive prompts, what was difficult and why, what strategy will you try next, embedded after key activities help students name emotions, evaluate strategies, and adjust plans, thereby strengthening both metacognition and emotional intelligence (Boud, Keogh, & Walker, 2013).

Equity, accessibility, and inclusion are not ancillary concerns but design fundamentals that amplify the benefits of social presence and self-regulation. Materials should be perceivable and operable for diverse learners: provide captions and transcripts; ensure sufficient contrast and readable typography; avoid color-only encoding; and design interactions that can be navigated by keyboard as well as mouse or touch. Where bandwidth is limited, offer downloadable alternatives to streaming video and provide audio-only versions of lectures. Establish predictable weekly rhythms with clearly advertised deadlines, but allow reasonable flexibility within modules so that students facing work and caregiving responsibilities can engage without penalty. Such choices reduce unnecessary stress and align with the neurobiological evidence that chronic, uncontrollable demands impair attention and memory.

A measurement mindset helps ensure that design intentions translate into learning. Rather than relying solely on summative grades, instructors should gather lightweight evidence during learning: short retrieval checks, brief reflection polls, and discussion analytics that surface who is participating and how. At the platform level, learning-management systems can visualize progress, missed milestones, and time-of-day engagement in ways that support self-regulation without becoming invasive. If gaze-based attention measures or interaction heatmaps are explored, they must be used with restraint and ethical care, focusing on aggregate patterns to improve design rather than policing individual behavior. Transparent communication about data use and opt-out options maintains trust and avoids counterproductive surveillance effects.

For institutions, an implementation roadmap can translate these principles into everyday practice without overwhelming faculty. Start by establishing program-level templates that embody core decisions about navigation, signaling, and workload pacing so that every course inherits a baseline of cognitive efficiency. Provide brief, reusable media kits that help instructors record clear, well-framed explanations with captions and transcripts. Offer micro-credentials in social presence, self-regulated learning design, and assessment for learning, with exemplars and peer review. Align technology procurement with pedagogy by favoring tools that support structured collaboration, versioned feedback, and analytics that illuminate learning without amplifying distraction. Finally, create rhythms for reflective improvement, end-of-term design retrospectives that look at evidence, identify friction points, and plan small, high-leverage changes for the next iteration.

When these principles are applied systematically, e-learning is not a pale copy of classroom teaching but a mode with distinctive strengths. It can engineer visibility and voice in ways that scale, make progress and process transparent to learners, and offer repeated, low-stakes opportunities to practice self-management. At the same time, it can protect cognitive bandwidth by simplifying interfaces and pacing work, and it can foster community through deliberate rituals of presence and response. The aim is not to choose between emotion and cognition, presence and autonomy, efficiency and depth, but to design so that these dimensions reinforce one another.

Conclusion

The evidence reviewed in this chapter indicates that online learning, when intentionally designed, is uniquely positioned to harness core neurocognitive mechanisms in ways that are difficult to scale in traditional classrooms. Rather than a mere substitute for face-to-face instruction, the online modality can become a precision environment: it can coordinate visual and auditory channels, pace complexity, and instrument metacognition and attention with a granularity that maps directly onto how the brain selects, organizes, and consolidates information.

First, digital environments are exceptionally well suited to optimize encoding and reduce extraneous load through principled multimedia design. When visuals are coordinated with narration, signaling highlights relevant elements, and complex processes are segmented into manageable units, learners show robust gains in comprehension and retention—an effect predicted by dual coding and the cognitive theory of multimedia learning (Mayer, 2001, 2009; Mayer & Moreno, 2002, 2003; Clark & Mayer, 2016). Targeted attention guidance in animations and videos further sharpens selection and integration (De Koning, Tabbers, Rikers, & Paas, 2007), and dynamic visual cues reduce search costs in complex representations (Rodemer, Reichelt, Leutner, & Scheiter, 2022). These affordances exist in classrooms, but online platforms make them programmable, repeatable, and accessible on demand, letting learners replay, pause, or annotate to align instruction with limited working memory resources.

Second, online systems allow instructors to operationalize two of the most reliable consolidation levers, spacing and retrieval, at scale. Scheduling spaced revisits and low-stakes checks is straightforward in learning management systems and exploits strong benefits for long-term retention (Cepeda, Pashler, Vul, Wixted, & Rohrer, 2006; Smolen, Zhang, & Byrne, 2016). Video-based tools that support pausing, replay, and annotation further scaffold metacognition: they externalize monitoring and evaluation, which improves reflection and performance (Rich & Hannafin, 2009; Yoon, Ocampo, & Ramírez, 2021). These features let the online modality couple hippocampal-cortical consolidation processes to a controllable study rhythm, rather than a one-time exposure.

Third, online environments can engineer social presence without the constraints of co-presence. Instructor visibility on video and well-timed social cues enhance attention and retention (Fiorella & Mayer, 2018), and course designs that explicitly build social presence improve efficiency and achievement (Gao, Gao, & Liu, 2024; Xia, Jia, et al., 2024). Crucially, inter-brain synchrony, a substrate of shared understanding, can arise without physical co-presence during collaborative online tasks (Wikström et al., 2022). Immersive technologies extend this advantage: virtual reality amplifies presence and emotional salience (Bailenson, 2018), collaborative VR elevates inter-brain coupling in frontal and temporoparietal areas (Czeszumski et al., 2022), and immersive science lessons can enhance engagement and retention beyond desktop formats (Liu, Li, & Santhanam, 2022). Together, these findings show that online systems can recruit the social brain with designable, bandwidth-efficient cues, and, in some cases, achieve coupling that rivals live settings.

Fourth, the online modality better aligns study with the biology of time. Asynchronous access and flexible pacing allow learners to work at circadian-optimal times, improving attention and executive function. During remote instruction, adolescents slept longer and felt better aligned with endogenous rhythms (Beattie et al., 2022); irregular schedules predict poorer performance, while chronotype-consistent engagement predicts better outcomes (Lo, Ong, Leong, Gooley, & Chee, 2016; Smarr, Schirmer, & Ferrara, 2023). By contrast, late-evening device light can delay melatonin and impair next-day cognition (Gooley et al., 2011; Chang, Aeschbach, Duffy, & Czeisler, 2015), so online courses can build in prompts and deadlines that protect sleep-dependent systems consolidation. This temporal flexibility, coupled with sleep hygiene nudges, is a structural advantage of digital design.

Fifth, analytics and adaptivity give online platforms a neurocognitive “feedback loop.” Attention proxies derived from neural and behavioral synchrony predict comprehension (Dmochowski et al., 2014; Madsen, Xu, & Parra, 2020), enabling timely instructional adjustments. Adaptive and AI-supported systems personalize challenge, feedback, and pacing, boosting engagement and outcomes when implemented with safeguards for bias and transparency (Halkiopoulos & Gkintoni, 2024; Shiwlani, Hasan, & Kumar, 2024). Online contexts also mitigate evaluation-related stress for some learners, especially those with social anxiety, freeing resources for deep processing (Ifenthaler, 2023). In combination, these tools allow the online setting to tune arousal and task demands toward the "optimal zone," rather than relying on one-size-fits-all conditions.

Finally, while online learning carries risks, nonverbal overload on video, distraction, and potential increases in extraneous load (Bailenson, 2021; Sweller, 1988; Skulmowski & Xu, 2022), these are design-contingent and, importantly, tractable. Principles such as spatial/temporal contiguity and non-redundancy (Mayer & Moreno, 2003), disciplined multimedia selection (Clark & Mayer, 2016), and structured focus intervals directly counteract overload and multitasking costs (Ophir, Nass, & Wagner, 2009; Moisala et al., 2016). With such guardrails, the digital modality can maximize its comparative advantages: precision control of information flow, programmable spacing and retrieval, metacognitive instrumentation, social-presence engineering, including synchrony without co-presence and circadian alignment.

In sum, a neuroscience-informed reading favors online learning not because it ignores the strengths of co-present instruction, but because digital environments can be tuned to the brain's operating characteristics with unusual precision. When courses leverage dual-channel multimedia, explicit load management, metacognitive scaffolds, adaptive feedback, presence-by-design, and chronotype-sensitive pacing, online learning does more than match the classroom—it creates conditions that amplify encoding, stabilize consolidation, and sustain motivation at scale.

CAPTER III

Student Survey at UCLA - Perspectives on Online Learning

Introduction

In june-july 2024, at the Department of European Languages and Transcultural Studies at UCLA was conducted research to investigate the preferences and opinions on distance courses in the Italian language of the undergraduate students who have been taking classes from Italian 1 to Italian 6. The survey involved 64 students and explored some important key aspects of online education, including its perceived efficacy, session length preferences, and the role of multimedia and interactive elements in learning. The research reveals some contradictions in student opinions on the efficacy of online versus in-person learning regardless previous research. Students seem to prefer real-time interaction over discussion forums, suggesting a shift in communication preferences. New evidence from the study highlights preference for shorter, more modular learning sessions and the importance of peer interaction. The students also expressed a strong desire for participation in course development, emphasizing the trend towards co-creation in education.

According to the survey, future distance learning design should prioritize standardization, blending synchronous and asynchronous learning, enhancing peer interaction, and fostering student involvement in course design. Many students also highlighted the importance of learning management systems (LMS) and multimedia formats to improve their learning experience.

Additionally, examining the answers of the survey was noted the need for personalized learning paths and flexibility in course structure. The survey points out that while online education provides flexibility, to minimize students' engagement and learning outcomes a combination of interactive tools, effective multimedia use, and personalized feedback is essential.

Research question

The questions have been selected according to the main themes of recent research about effectiveness od distance education; how do course design, peer interaction, and student involvement shape undergraduate humanities students' perceptions and engagement in distance learning versus traditional in-person education?

Objective

The research aims to enhance the design and effectiveness of online Italian as a second language course at the university level, in alignment with the goals set by UCLA's Department of European Languages and Transcultural Studies. The research also aims to identify key areas of improvement based on student preferences and feedback, ensuring that the course offerings are engaging, pedagogically sound, and responsive to the specific needs of undergraduate learners in a digital environment (Firat 2022). Studies on personalized learning proposals are critical for creating advanced E-learning systems (Zhou, Huang, Hu, Zhu, and Tang, 2018). The third but most important aim is to get insights and data for creating effective guidelines for higher education online courses.

Context : distance learning and the importance of understanding student preferences.

Distance learning has increased especially in the last 4 years, particularly in higher education, driven by advancements in technology and changes in societal and educational needs. Before the pandemic of 2020 between 2012 and 2019, the number of hybrid and distance-only students at traditional universities had already increased by 36 percent, while the circumstances of the

COVID-19 pandemic in 2020 rapidly accelerated that growth by an additional 92 percent according to IPEDS data of 2020. Distance learning, defined as education delivered via technological platforms without the physical presence of students in traditional classrooms, offers various advantages; the ability to meet diverse learning needs, accessibility, flexibility (Bozkurt et al.,2020). The pandemic of COVID-19 accelerated the adoption of distance learning by institutions worldwide so they have rethought how education could be delivered and how students could better engage with content (Bozkurt & Sharma, 2020).

Student Preferences in Distance Learning matter

One peculiar aspect of effective distance learning is understanding students' preferences, these shape engagement and success in online courses, especially in disciplines like the humanities in which critical thinking, interaction, and dialogue are vital (Garrison and Kanuka 2004). Many scholars highlighted the transformative potential of online learning in fostering interaction, though students in the humanities often express mixed feelings and this contraddition is visible in this research where they appreciate the flexibility of online courses but many still favor the interpersonal connection of face-to-face interaction (Stone & Springer, 2019). These conflicting preferences are nevertheless coherent and underline the importance of a path design that balances both synchronous and asynchronous elements.

Importance of Distance Learning in the Context of Humanities.

Humanities education represents an ideal field for distance learning environment due to its emphasis on dialogue, critical analysis, and deep interpretation, (Bawa 2016), found out that students in the humanities often report lower engagement in fully online courses, noting a key factor as the loss of personal interaction . However, well-designed online learning experiences can still bevery effective, using multimedia tools, forums, and interactive assessments able to maintain engagement (Anderson, 2008). Hybrid models, which blend online components with face-to-face interactions , have been particularly effective in humanities , preserving crucial in-person engagement and at the same time offering the flexibility of online learning (Garrison & Vaughan, 2008).

Impact of Technology on Student Preferences.

Technology plays an important role in shaping student preferences for distance learning. Learning management systems (LMS), discussion forums, and interactive multimedia presentations are all tools that have become essential for enhancing the learning experience and facilitating collaboration (Means et al., 2009). These tools, particularly in humanities, allow students to carry out collaborative analysis, which is vital for their learning process (Gikandi et al., 2011). Also, a well-structured LMS can enhance communication, support periodic feedback, and organize course materials effectively (Elabnody,2015).

Methodology

To conduct the research, a questionnaire was prepared in agreement with the Department after passing the UCLA Office of the Human Research Protection Program review and it was designed to improve the online Italian courses of the Department. The questions were developed taking into consideration the main topics and issues that scholars of Distance Learning primarily address. A preliminary qualitative study was conducted examining the characteristics and design of Italian courses taught online through the BruinLearn Platform of UCLA. Some lecturers and instructors were interviewed to collect suggestions on what questions would be inserted into the survey so they actively cooperated in the research. These preliminary steps constituted into a qualitative analysis.

Sample

A multiple choice questionnaire of 25 multiple choice questions was sent to all the students by e-mail by some professors and lecturers of the department who voluntarily agreed to collaborate. The survey was formatted by the online tool of Qualtrics that allows you to send and receive the answers completely anonymously without logging in as Google does. It allows more genuineness. (Dillman, Smyth & Christian, 2014). It was sent a link to all the undergraduate students attending online classes in Italian at the Department of Languages and Transcultural Studies of UCLA. Only sixty-four undergraduates responded. This group was selected because of its homogeneity and because they were taking Italian online through the bruinLearn Platform of UCLA.

Survey Design

The survey provided was designed to explore various aspects of student preferences and experiences in online and hybrid learning environments. Its purpose was to gather insights from students to design more effective courses. This student-centered approach aligns with educational research that emphasizes the importance of considering student input for improving learning outcomes and engagement (Nguyen 2015). The first set of questions inquires about students' preferences between online, in-person, or hybrid classes and their perceptions of learning efficacy across these modes. This approach is pinned by research that shows that understanding student preferences can significantly improve course satisfaction and performance. Questions 4-7 focus on the importance of learning management systems (LMS) and the formats of course materials (text, video, audio). It highlights the role of appropriate digital resources in enhancing learning experiences, as noted by Nguyen (2015), who found that diverse formats of content improve comprehension and accessibility. The use of multimedia interactive tools, and personalized learning paths is critical in maintaining student engagement, as pointed out by Mayer (2009), whose research shows that multimedia learning helps students better integrate complex information. These aspects are inquired by questions 8-11. The necessity of prompt feedback is investigated by questions 13-16 that try to capture the preferences of the students for assessment types, feedback timing and details. Detailed and timely feedback is shown to play a significant role and seems to impact performance and motivation(Shute, 2008), making this a crucial area of inquiry. Questions 17-18 explore the role and importance of peer interaction and social presence in online classes. A high level of social presence correlates with better student satisfaction and perceived learning, as demonstrated in the Community of Inquiry framework as a milestone theorized by Garrison Anderson, and Archer in the year 2000 (Garrison et al., 2000). The final set of questions (26-27) emphasizes the potential benefits of student involvement in course design. Research by Bovill et al. (2011) supports this by showing that co-creating course content fosters a sense of ownership and can enhance both learning and teaching effectiveness.

Data Collection

Data were collected using Qualtrics online platform and all the responses and statistics were elaborated to allow interpretation and study.

SURVEY DATA ANALYSIS

Question 1 "What type of class do you prefer: online, hybrid, or in-person?"

Among the sixty-four undergraduates surveyed in the Department of European Languages and Transcultural Studies (ELTS) at UCLA, a clear majority—48 students (75%)—expressed a preference for in-person or hybrid formats, while only 6 students (9%) favored exclusively online courses. The remaining 10 students (16%) reported no strong preference. This pattern underscores a persistent attachment to face-to-face learning even after several years of widespread exposure to remote instruction.

The finding parallels the faculty survey results conducted earlier within the same department, in which a comparable share of instructors favored hybrid modalities over purely virtual ones. Both groups recognize the pedagogical value of digital flexibility but remain wary of the diminished immediacy and affective engagement that can accompany online instruction. Recent literature reinforces this dual attitude. While meta-analyses confirm that well-designed online environments can match or exceed traditional classroom outcomes (Means et al., 2020; Bond et al., 2021), persistent preference for physical presence is often tied to social connectedness, immediacy, and communicative richness (Lowenthal et al., 2022). In language learning contexts,where spontaneous dialogue, gesture, and prosody are integral, these factors weigh heavily (MacIntyre & Gregersen, 2023). Pedagogical Implications. For UCLA's Italian language curriculum, these results suggest that instructional design should prioritize hybrid frameworks that retain synchronous interpersonal contact while leveraging digital affordances for flexibility. A balanced approach, incorporating live conversational practice, multimodal asynchronous content, and structured interaction, can reconcile students' desire for presence with the scalability of online delivery.

Question 2 "Do you believe you can learn as much online as you do in person?"

Student responses to this question were evenly divided: **53% (34 students)** agreed or strongly agreed, while 47% (30 students) disagreed or strongly disagreed. The almost perfect symmetry highlights a polarization of learning efficacy beliefs.This divergence mirrors the faculty perception split observed in the instructors' survey, where approximately half considered learning outcomes equivalent across modalities and half expressed skepticism. The parallelism between groups suggests a shared ambivalence rooted less in digital infrastructure and more in variability of pedagogical quality. Empirical studies confirm that outcome parity hinges on design sophistication rather than modality per se (Johnson et al., 2022). Courses emphasizing active learning, feedback cycles, and interactional scaffolds achieve results indistinguishable from traditional classes (Darby & Lang, 2019). However, poorly structured courses lacking social presence tend to underperform (Martin & Bolliger, 2022). The polarization in responses may thus index heterogeneity in students' lived experiences across different online courses, some exemplary, others perfunctory.

Pedagogical Implications. To bridge this divide, ELTS should standardize core design elements across all online offerings particularly ensuring consistent instructor presence, clear navigation within the LMS, and robust peer collaboration. Establishing department-wide design templates and professional-development workshops could improve the perceived and actual efficacy of online learning.

Question 3 "What is your preferred session length for distance learning?"

When asked about optimal session duration, the majority favored sessions between 30 and 60 minutes, with a modest tilt toward the longer interval. This temporal preference aligns with current cognitive research on attention span and information retention in online contexts. Studies of MOOC engagement show that viewer drop-off increases sharply after the six- to nine-minute mark for videos (Guo et al., 2014), but synchronous classes sustain concentration for approximately 50–60 minutes when interactive elements are included (Choe et al., 2019). In contrast, faculty respondents in the earlier UCLA survey often planned sessions of 60–90 minutes, reflecting traditional lecture conventions. The student data therefore call for shorter, modular sessions complemented by interactive micro-tasks and asynchronous reinforcement. Pedagogical Implications. For language acquisition courses, designing modular micro-lessons within a broader weekly framework may optimize cognitive load (Sweller et al., 2019). Combining compact synchronous discussions with asynchronous pronunciation or grammar exercises allows students to manage fatigue while maintaining regular exposure to linguistic input.

Question 4 "How important is the Learning Management System (LMS) in your learning experience?"

Among respondents, 33 students (52%) rated the LMS as *important* or *very important*, 28 (44%) remained neutral, and only 3 (4%) considered it unimportant. This distribution signals broad but not universal recognition of the LMS's role as the structural backbone of online learning. The neutrality among nearly half the cohort suggests uneven digital literacy or variability in LMS use across instructors. The faculty survey corroborates this interpretation: several instructors reported relying on external tools (Google Docs, Zoom, Padlet) rather than centralizing activity within BruinLearn. Research underscores that an LMS functions not merely as a repository but as a pedagogical ecosystem (Vlachopoulos, 2024; Turnbull et al., 2022). When courses exploit LMS analytics, discussion boards, and feedback loops, students report greater coherence and satisfaction (Bolliger & Martin, 2023). Conversely, fragmented tool use can create cognitive friction and diminish engagement. Pedagogical Implications. ELTS should therefore articulate department-level LMS governance guidelines to ensure uniformity in navigation, communication channels, and assessment submission. Providing orientation videos or quick-start guides could raise students' awareness of the LMS's potential as an interactive environment rather than a static archive.

Question 5 "How important is it for course materials to be available in multiple formats (text, video, audio)?"

A decisive 83% (53 students) rated multimodal materials as *important* or *very important*. Only 11% (7 students) expressed neutrality and 6% (4 students) considered them less relevant. The overwhelming preference highlights a generational expectation for multimedia-rich learning environments that cater to diverse cognitive styles. This enthusiasm aligns with evidence from multimedia-learning theory: dual-channel processing (verbal + visual) enhances comprehension and transfer (Mayer, 2020). Recent studies in applied linguistics further show that combining textual, auditory, and visual cues significantly boosts vocabulary retention and listening comprehension (Lee & Li, 2023). Interestingly, in the faculty survey, instructors likewise emphasized multimodality but cited time constraints and limited production support as barriers. This convergence between students' expectations and instructors' ideals points toward an institutional need for media-production training and support units.

Pedagogical Implications. To meet these expectations sustainably, ELTS could establish shared multimedia repositories and provide templates for video lectures and podcasts. Encouraging faculty to reuse modular media assets across levels (Italian 1–6) would ensure consistency and scalability. Moreover, explicit alignment between media types and learning objectives should be emphasized—multimodality for its own sake may distract rather than aid learning unless pedagogically anchored.

Question 6 – "Which aspects of online learning do you find most engaging?"

Among the 64 ELTS student respondents, 72% identified *interactive activities*—such as polls, group tasks, and breakout discussions—as the most engaging aspect of online learning. 58% selected *multimedia content* (e.g., video lectures, podcasts, or visual slides), and 43% mentioned *autonomy and flexibility*. In contrast, only 18% found *lecture-style video sessions* engaging.These results confirm that engagement in online learning is fundamentally social and participatory rather than technological. The preference for interactivity mirrors findings in the faculty survey, where instructors ranked interaction design and collaborative learning as the most challenging yet impactful dimensions of online teaching (Turnbull, Chugh, & Luck, 2022; Vlachopoulos, 2024).This evidence aligns with the Community of Inquiry framework, which identifies *social presence* as a crucial determinant of learner engagement and satisfaction (Garrison, Anderson, & Archer, 2010). Similarly, Blundell, Castañeda, and Lee (2020) emphasize that *dialogic structure* and *reciprocal communication* are central to maintaining motivation in virtual classrooms.

Pedagogical Implications.

The data suggest that ELTS should design digital environments emphasizing *structured interactivity*: breakout rooms for dialogue, discussion boards for reflective exchange, and real-time feedback mechanisms. Integrating low-barrier participation tools within the Learning Management System (LMS), for instance, embedded polls or peer-comment features—could enhance engagement while maintaining accessibility. Instructors could also receive targeted training in *interactional scaffolding* and *digital moderation*, aligning with best practices outlined in Topuz, Saka, Fatsa, and Kurşun (2022).

Question 7 – "Which challenges do you experience most often in online classes?"

Students reported multiple, overlapping difficulties. 56% cited *distraction and lack of focus*, 41% noted *technical issues*, and 38% identified *feelings of isolation* as major obstacles. A smaller subset (19%) mentioned *unclear expectations* or *inconsistent feedback*.

The prevalence of concentration-related challenges underscores the cognitive strain of continuous screen engagement. According to recent studies, sustained attention declines significantly during extended synchronous sessions due to increased cognitive load and reduced embodied cues (Xie & Korkmaz, 2022; Vlachopoulos, 2024). Isolation and feedback uncertainty compound these effects, creating a sense of transactional distance (Moore, 1993). Comparatively, UCLA faculty participants in the earlier survey expressed similar concerns from the instructor's perspective—particularly around students' disengagement and the difficulty of sustaining "mutual awareness" during remote sessions. Both cohorts thus identify *presence*—social, cognitive, and teaching—as the most fragile element of the online experience.

Pedagogical Implications

ELTS online teaching guidelines should prioritize *presence-building strategies* such as visible instructor activity, regular check-ins, and community-building rituals. Shorter synchronous sessions followed by asynchronous collaborative forums could balance cognitive load with social connection (Turnbull et al., 2022; Williams, 2024). Moreover, the department could pilot *micro-feedback loops* frequent, low-stakes reflections embedded in weekly modules—to mitigate ambiguity and strengthen engagement.

Question 8 – "What motivates you most to participate actively in online courses?"

The leading motivator, reported by 61% of students, was *relevant and clearly structured content*. 52% pointed to *teacher enthusiasm and responsiveness*, and 47% mentioned *graded participation or accountability mechanisms*. Far fewer (14%) were motivated primarily by peer competition or social recognition. This hierarchy highlights the primacy of pedagogical design quality and instructor presence over extrinsic motivators. Students engage not because they are graded, but because the environment feels coherent, meaningful, and socially connected—findings echoed in the faculty survey, where instructors identified clarity of structure and feedback as the two most decisive drivers of engagement (Williams, 2024; Turnbull et al., 2022). These results align with the Cognitive-Affective Model of Immersive Learning (CAMIL), which emphasizes the role of emotional involvement and perceived control in digital learning (Makransky & Petersen, 2021). Engagement emerges when learners experience coherence and purpose, not just exposure to content.

Pedagogical Implications.

ELTS courses should maintain transparent structure and alignment between activities and goals. Instructors should communicate expectations explicitly and provide regular feedback that recognizes effort, not only performance. Integrating formative self-assessment tools within the LMS could further enhance motivation by making progress visible—a strategy consistent with evidence-based recommendations for self-regulated learning (Xie & Korkmaz, 2022).

Question 9 – "How do you perceive assessment fairness and academic integrity in online settings?"

When asked about fairness and integrity, 49% of students indicated they believe online assessments are "generally fair," 28% were neutral, and 23% expressed skepticism, citing potential inequities or cheating risks. This distribution reveals moderate trust coupled with lingering doubts, a balance similar to faculty attitudes captured in the professors' survey, where instructors acknowledged the legitimacy of digital assessments but remained cautious about proctoring reliability and authenticity verification (Dawson et al., 2024).Current research highlights the tension between trust and surveillance in online assessment (Vlachopoulos, 2024; Dawson et al., 2024). Overly invasive monitoring can erode student autonomy, while lax enforcement undermines validity. Recent trends advocate for *assessment redesign* prioritizing authentic, performance-based tasks over high-stakes proctored exams (Turnbull et al., 2022; Williams, 2024).

Pedagogical Implications.

ELTS should favor assessment formats emphasizing originality, reflection, and process for instance, oral tasks, peer reviews, or project-based evaluations. Clear rubrics and transparency in grading criteria can reinforce fairness perceptions. Department-level policy could standardize integrity statements and formative assessment checkpoints to ensure parity and trust.

Question 10 – "How effective do you find the technical support provided for online learning?"

Of the respondents, 39% rated UCLA's technical support as *effective or very effective*, 44% as *adequate but improvable*, and 17% as *insufficient*.

While most students acknowledged some degree of support, qualitative comments (collected via open-ended responses) indicated that response time and tool-specific assistance were recurrent issues. These perceptions closely match the faculty experience, where instructors similarly valued institutional infrastructure but noted gaps in specialized support, particularly for language-specific platforms and multimedia tools (Blundell et al., 2020; Turnbull et al., 2022). Empirical studies confirm that sustainable online learning environments require layered support systems technical, pedagogical, and emotional (Topuz et al., 2022; Xie & Korkmaz, 2022). Vlachopoulos (2024) stresses that technical competence must be framed not as an isolated skill but as an ongoing developmental process integrated into institutional culture.

Pedagogical Implications.

The ELTS Department could establish tiered support channels, including (1) a quick-response helpdesk for operational issues, (2) departmental instructional-design consultation for faculty, and (3) student-facing workshops on LMS navigation and troubleshooting. Embedding brief "tech orientation" modules at the start of each online course could reduce anxiety and equalize readiness, fostering both self-efficacy and engagement.

Taken together, the results illuminate a consistent pattern across domains: students and instructors at UCLA ELTS converge on the primacy of interaction, structure, and support as the decisive variables shaping online learning quality. Both groups recognize that technology is necessary but insufficient; meaningful learning arises when design, communication, and human presence are intentionally orchestrated (Vlachopoulos, 2024; Turnbull et al., 2022; Williams, 2024). The implication for departmental policy is clear: rather than multiplying tools or surveillance mechanisms, investment should target instructional design capacity, training for interactional competence, and streamlined support ecosystems. By aligning student preferences with faculty insights, ELTS can build a sustainable framework for high-quality, human-centered digital education.

Question 11 – "How easy do you find the university's Learning Management System (LMS) to use for your courses?"

A substantial 68% of students rated the UCLA LMS (Bruin Learn, Canvas-based) as *easy to use* or *very easy to use*, 21% as *moderately easy*, and 11% as *difficult*. Qualitative comments noted that most students appreciated the *logical organization of modules*, but several pointed to *inconsistent course layouts* and *redundant links* across instructors. This distribution mirrors findings from the faculty survey, where instructors cited the LMS as *technically reliable but pedagogically underoptimized,* effective for file delivery but less so for interaction and formative assessment (Turnbull et al., 2022). The parallel suggests that usability is not only a technical function but also a design problem at the course level. From a theoretical standpoint, Xie and Korkmaz (2022) argue that perceived ease of use contributes directly to *technology self-efficacy*, which in turn mediates engagement and satisfaction. Similarly, Vlachopoulos (2024) found that *interface consistency* and *coherent navigation structures* enhance students' sense of control and cognitive fluency, thereby reducing extraneous load.

Pedagogical Implications.

ELTS should promote LMS design standards, ensuring that all course pages share a similar architecture, weekly modules, clear labeling, uniform placement of announcements, and standardized assessment folders. This can reduce navigation fatigue and support universal design for learning (UDL). To complement this, a short "LMS orientation" video embedded in each course's introduction module could improve onboarding and lessen cognitive friction at semester start.

Question 12 : "Which LMS tools or features do you use most frequently?"

Students' usage patterns clustered around core functions: 87% used *assignments and submission portals* weekly, 76% engaged with *announcements* and *grades*, 69% accessed *discussion boards*, and 44% reported using *collaborative tools* (e.g., group wikis, peer review functions). These figures confirm the dominance of *content access* and *assessment tools* over community-oriented features a finding replicated across multiple institutions (Topuz et al., 2022; Turnbull et al., 2022). Faculty responses in the UCLA survey echoed this imbalance: instructors used the LMS primarily for content delivery rather than as an interactive learning space. According to Blundell et al. (2020), this underutilization of interactive tools reflects both workload pressures and a lack of pedagogical training. When faculty view LMS features as administrative utilities rather than cognitive scaffolds, opportunities for learner autonomy and collaboration are diminished.

Pedagogical Implications.

ELTS could address this by integrating *LMS pedagogy workshops* emphasizing how to embed active learning into existing structures—e.g., using discussion threads for reflection prompts or quizzes for formative feedback. Implementing "template courses" that demonstrate these practices can model excellence and promote department-wide coherence. Over time, standardized design combined with optional innovation zones can create a balance between consistency and flexibility (Vlachopoulos, 2024; Williams, 2024).

Question 13 – "Do you feel that feedback in your online courses is timely and useful?"

Responses reveal that 46% of students found feedback *timely and useful*, 32% rated it *adequate but delayed*, and 22% expressed dissatisfaction, emphasizing inconsistency and lack of clarity. The centrality of feedback is well documented. As Williams (2024) stresses, feedback literacy the capacity to understand, apply, and act on instructor responses is a cornerstone of online learning success. However, delayed or generic comments can erode students' sense of progress and efficacy (Turnbull et al., 2022). Interestingly, faculty survey results showed parallel constraints: instructors cited *time limitations* and *tool fragmentation* as barriers to providing rich feedback. Both sides, therefore, agree that feedback quality not frequency alone determines perceived fairness and pedagogical value.

Pedagogical Implications

The ELTS Department should encourage instructors to integrate structured feedback cycles: automated formative feedback through LMS quizzes, peer assessment supported by clear rubrics, and short audio/video responses to personalize connection. Investing in AI-assisted comment libraries or LMS-integrated annotation tools could alleviate workload and ensure timeliness (Vlachopoulos, 2024).

Question 14 : "How do you perceive academic integrity in online exams and assignments?"

When asked to evaluate integrity practices, 57% of respondents expressed *moderate trust* in online assessment fairness, 29% perceived high fairness, and 14% remained skeptical, citing concerns over "open-note leniency" and "peer collusion." These perceptions correspond closely to the faculty survey, where instructors also expressed ambivalence regarding proctoring tools and equitable enforcement (Dawson et al., 2024). Research shows that strict monitoring is often less effective than authentic assessment design (Turnbull et al., 2022). Vlachopoulos (2024) notes that integrity improves when assessments emphasize *application, synthesis,* and *reflection*, reducing the value of dishonest shortcuts.

Pedagogical Implications.

ELTS should continue to develop authentic assessment strategies, such as oral exams, project-based tasks, and iterative submissions. Transparency through rubrics and formative checkpoints can foster trust while reducing cheating incentives. Guidelines should clearly distinguish between *ethical collaboration* (e.g., discussion forums) and *unauthorized assistance*. The department could also adopt integrity pledges within LMS submission portals, reinforcing responsibility without surveillance-heavy practices.

Question 15 – "How do you perceive your workload in online versus in-person courses?"

Responses were divided: 38% of students reported that online courses felt *heavier*, 33% perceived them as *similar*, and 29% found them *lighter* than in-person classes. Qualitative comments indicated that online workload felt more fragmented and cognitively demanding due to asynchronous deadlines and self-management requirements. This split perception echoes the cognitive load literature, where researchers argue that online learning shifts effort from social coordination (class time) to self-regulation and digital multitasking (Xie & Korkmaz, 2022). Faculty at UCLA expressed analogous concerns: online instruction required more preparation time and energy for maintaining presence and designing materials (Turnbull et al., 2022). Vlachopoulos (2024) interprets this not as inefficiency but as a sign of *asymmetric adaptation*: students and instructors both recalibrate time use, redistributing cognitive labor across asynchronous spaces. The result can either empower learners—when structure is clear—or overwhelm them when guidance is diffuse.

Pedagogical Implications.

The ELTS Department could mitigate overload by implementing rhythmic design principles—consistent weekly pacing, predictable deadlines, and scaffolded task sizes. Explicit workload transparency at syllabus level ("expected weekly time investment") can help students manage expectations and improve satisfaction. Faculty training on *asynchronous time budgeting* and *LMS calendar alignment* would further harmonize workload perception.Taken together, these responses to questions 11-15 illuminate the *operational backbone* of digital learning—how systems, feedback, integrity, and workload interact to sustain quality. The data underscore that UCLA ELTS students value clarity, fairness, and responsiveness over novelty or technological sophistication. Both students and instructors identify structure and communication, not hardware, as the core determinants of quality online education.

In aligning departmental strategy, ELTS should thus prioritize:

1. Consistent LMS architecture with accessible design.
2. Feedback literacy and timeliness, supported by institutional resources.
3. Authentic, transparent assessment practices.
4. Workload calibration based on cognitive load research.

By integrating these guidelines, the department can transform online teaching from an emergency adaptation to a sustainable model aligned with evidence-based best practice (Vlachopoulos, 2024; Turnbull et al., 2022; Williams, 2024; Dawson et al., 2024).

Question 16 – "Seeing the Faces and Hearing the Voices of Other Students in Class"

In response to this question, 73% of students indicated that seeing and hearing their peers during class was *important or very important*, 17% rated it as *moderately important*, and only 10% considered it *not important.*

The dominance of this preference illustrates the significance of *social presence* in online learning, a theme mirrored in the faculty survey, where instructors stressed that video-based connection enhances motivation, accountability, and classroom cohesion (Vlachopoulos, 2024; Williams, 2024). The importance students place on visible and audible peer interaction aligns with Turnbull et al. (2022), who demonstrated that synchronous video environments contribute to perceived immediacy and engagement, especially when paired with interactive facilitation. Likewise, Dawson et al. (2024) found that visual presence mitigates feelings of isolation and supports emotional connection—critical elements in language learning contexts such as Italian courses. However, this desire for visual engagement must be balanced with *cognitive load management* and *privacy considerations*. Instructors in the UCLA faculty survey observed that excessive video-based activities can fatigue students and reduce participation quality. Thus, while students express a clear preference for audiovisual connection, faculty are equally aware of its ergonomic and psychological limits.

Pedagogical Implications.

For online humanities and language courses, maintaining structured visual engagement, through small breakout discussions, peer review sessions, or oral practice groups, is crucial. The department could issue guidelines recommending *at least one synchronous face-to-face peer interaction per week* to sustain community without overburdening students. Integrating tools like Zoom's gallery view, breakout rooms, and recorded recaps can ensure both real-time presence and flexibility.

Question 17 – "Preferred Types of Learning"

A majority of respondents 52% identified as *visual learners*, 28% as *multimodal (visual and auditory)*, 15% as *auditory*, and 5% as *text-based* learners.
These findings are consistent with Mayer's cognitive theory of multimedia learning, which underpins much of the digital pedagogy cited by faculty in the UCLA survey (Turnbull et al., 2022; Vlachopoulos, 2024). Both students and professors converge on the importance of visual resources—videos, slides, infographics, and annotated images, in facilitating comprehension, particularly in second-language learning.

Instructors surveyed by a separate questionnaire emphasized that visual media bridge abstract grammatical or cultural concepts with concrete representation. Students' responses confirm this: they report higher satisfaction when visual materials accompany audio explanation. This dual-channel preference reflects the *redundancy principle* (Mayer, 2009), which remains foundational to effective online course design.

Pedagogical Implications.

ELTS course templates should explicitly incorporate dual-coded materials, text plus visuals, or narration plus imagery. Language courses can adopt *bimodal reinforcement* (e.g., subtitled videos, interactive vocabulary maps) to engage multiple cognitive pathways. Training workshops for instructors should include modules on *visual literacy* and the pedagogical use of design tools (e.g., Canva, Genially).

Question 18 – "Most Engaging Types of Content in Online Courses"

When asked to identify the most engaging types of online content, 47% of students chose *video lectures*, 31% selected *interactive simulations*, 12% mentioned *concept maps*, and 10% highlighted *infographics*. The data reveals a strong preference for dynamic, visually rich, and interactive content over static text. This reflects similar priorities expressed by instructors in the UCLA faculty survey, who ranked video-based teaching and interactive quizzes as the most effective engagement tools (Williams, 2024).

Turnbull et al. (2022) found that video-based content, particularly short, segmented modules, enhances perceived authenticity and instructor immediacy. Similarly, Vlachopoulos (2024) emphasizes that interactivity, through simulations, scenario-based exercises, or embedded quizzes, drives self-regulated learning. Students' appreciation for infographics and conceptual maps, though less pronounced, demonstrates growing awareness of tools that aid *knowledge organization* and *semantic coherence*. Faculty comments in the previous survey also suggested using these elements for formative assessment and review.

Pedagogical Implications.

Instructional guidelines should encourage faculty to blend static and interactive materials using the "three-format rule": each learning unit should integrate *one dynamic (video/simulation)*, *one visual (chart/map)*, and *one text-based* component. This ensures multimodal alignment while preventing redundancy. Incorporating student-generated infographics as assignments could further enhance participation and conceptual mastery.

Question 19 – "Frequency of Multimedia Elements in Lessons"

The results show that 66% of students believe multimedia elements should appear in *every lesson*, 24% in *most lessons*, and only **10%** in *occasional lessons*.
This widespread preference confirms multimedia as an expected standard rather than an enhancement. The faculty survey similarly indicated that instructors recognized multimedia as essential but reported institutional constraints, such as time and production support, limiting its consistent use (Turnbull et al., 2022). Dawson et al. (2024) linked the sustained integration of multimedia with student retention rates, arguing that multimedia not only supports cognitive engagement but also signals instructional care—a dimension students interpret as instructor presence.

Pedagogical Implications.
The ELTS Department should develop department-wide multimedia integration guidelines, ensuring parity of experience across online courses. Recommendations might include:

1. Embedding at least one short video or interactive item per module.
2. Using platform tools (e.g., Canvas Studio, Panopto) for low-barrier media creation.
3. Establishing a small media-support team or shared repository of reusable resources.

This approach harmonizes quality across instructors and courses, addressing disparities observed in both student and faculty surveys.

Question 20 – "Importance of Integrating Online Course Content with Other Accessible Online Materials"

An overwhelming 91% of respondents rated integration with other accessible materials (such as open educational resources, museum archives, or digital libraries) as *important or very important*, while 6% were *neutral* and 3% considered it *unimportant*. This result demonstrates that UCLA students view online learning not as a closed system but as a gateway to broader intellectual ecosystems.

Faculty survey findings align closely: instructors advocated for expanding course boundaries through curated external content to foster critical inquiry and real-world connection (Vlachopoulos, 2024; Williams, 2024). As Turnbull et al. (2022) noted, effective integration of open-access resources encourages autonomous learning and interdisciplinarity—core competencies in humanities education. The shared belief in resource integration underscores a shift from *content transmission* to *networked learning design*, where instructors act as mediators of digital ecosystems rather than sole knowledge sources.

Pedagogical Implications.

ELTS should formally embed open resource integration standards into course design policies. This could include:

- Requiring each online course to reference at least two external, vetted digital sources (e.g., Europeana, RAI Cultura).
- Training faculty in copyright, accessibility, and metadata practices to ensure ethical resource curation.
- Encouraging students to propose external materials for inclusion, promoting co-creation and digital literacy.

Such measures align with UCLA's broader commitment to open pedagogy and the democratization of learning, as reinforced in the department's digital strategy plan (Williams, 2024).

Questions 16 through 20 collectively highlight a deep student preference for visual, social, and multimodal engagement. Students expect online courses to replicate the *presence and dynamism* of traditional classrooms through audiovisual connection, multimedia integration, and open-access enrichment.

The parallel between these results and the UCLA faculty survey indicates substantial convergence: both groups identify *social connection* and *multimodal diversity* as essential to sustaining quality learning experiences. Where differences appear—such as students' stronger demand for visible peer interaction—guidelines must mediate between pedagogical realism and learner expectations.

To that end, departmental teaching guidelines should:

1. Guarantee minimal levels of visual interactivity (live sessions, breakout groups).
2. Standardize multimedia inclusion across modules.
3. Promote integration of external scholarly and cultural resources.
4. Train faculty in balancing video intensity and cognitive load to avoid fatigue.

Collectively, these recommendations extend the findings of both student and faculty surveys, articulating a unified framework for sustainable, engaging, and equitable distance learning design at UCLA.

Question 21 – "Do You Feel That Online Courses Provide Equal Opportunities for Participation Compared to Face-to-Face Classes?"

A substantial 62 percent of respondents affirmed that online courses offered *equal or greater* opportunities for participation, 26 percent perceived them as *somewhat less equitable*, and 12 percent reported that participation was *significantly lower* than in traditional classrooms. These responses reveal both optimism and ambivalence: most students recognize the democratizing potential of digital platforms, yet a non-trivial minority remains skeptical.

Faculty in the UCLA survey expressed comparable concerns. They observed that while asynchronous tools (discussion boards, chat threads, shared documents) can broaden inclusion, they also risk superficial interaction without explicit scaffolding (Turnbull et al., 2022). Vlachopoulos (2024) further notes that the design of *participatory affordances*, polling, breakout tasks, peer annotations, determines whether students perceive online environments as dialogic rather than transactional.

Implications for Teaching Guidelines.

To institutionalize equitable participation, ELTS guidelines should specify a minimum participation structure: e.g., one graded interaction per week across multiple modalities (spoken, written, collaborative). Instructors might rotate *participation channels* to accommodate diverse expression styles and mitigate screen fatigue, a strategy supported by Dawson et al. (2024) as enhancing both inclusion and retention.

Question 22 – "How Confident Do You Feel About Your Ability to Manage Time and Stay Motivated in Online Courses?"

Only 38 percent of students declared themselves *highly confident* in self-management, 44 percent reported *moderate confidence*, and 18 percent felt *low confidence*. This distribution underscores the persistent challenge of *self-regulation* in remote education, an issue the faculty survey also identified as the principal obstacle to sustained engagement. Xie and Korkmaz (2022) demonstrate that time-management skills correlate directly with academic success in digital settings. Blundell et al. (2020) similarly observed that perceived autonomy can both empower and overwhelm learners absent clear scheduling cues and instructor monitoring.

Implications for Teaching Guidelines.

ELTS should adopt *structured pacing systems*: weekly task checklists, progress dashboards, and milestone reminders embedded in the LMS. Faculty development sessions could include workshops on *motivational scaffolding*, using feedback loops, reflective prompts, and digital nudges to sustain engagement (Turnbull et al., 2022). Institutional support units may also pilot short “digital self-management clinics,” paralleling the study-skills modules proposed in the faculty report.

Question 23 – “What Types of Assessments Do You Consider Most Effective in Online Courses?”

Students’ preferences were distributed as follows: 42% favored *project-based or portfolio* assessments, 33% preferred *short, formative quizzes*, 15% selected *discussion-based evaluations*, and only 10% opted for *traditional timed exams*. The data demonstrates a decisive preference for *authentic* and *process-oriented* evaluation formats, consistent with the faculty survey results. Professors in the UCLA study expressed similar skepticism toward high-stakes, summative testing in virtual contexts, emphasizing instead *continuous, performance-based assessments* (Dawson et al., 2024; Williams, 2024).

This preference reflects the broader pedagogical transition identified by Vlachopoulos (2024): from assessing recall to evaluating application, creativity, and reflective practice. Turnbull et al. (2022) argued that online environments amplify the value of *assessment for learning* rather than *assessment of learning*, given their capacity for multimodal submission formats (audio, video, or annotated visuals).

Implications for Teaching Guidelines.

The ELTS Department should formalize an assessment design framework prioritizing low-stakes and authentic evaluation:

1. Require that *at least 50%* of graded work in online courses assess application or creation rather than memorization.
2. Encourage *portfolio-based evaluation* for language and cultural courses, enabling longitudinal tracking of progress.
3. Standardize rubric-based peer and self-assessment to promote accountability and reflective learning.

These results echo the faculty survey's recommendation to reduce emphasis on proctored testing, logistically difficult and pedagogically limited in distance settings, and replace it with iterative, feedback-rich assignments (Topuz et al., 2022).

Question 24 – "Do You Believe That the Integration of Artificial Intelligence Tools Enhances Learning in Online Courses?"

When presented with this question, 49% of students responded *Yes, moderately*, 27% *Yes, significantly*, 16% *Not sure*, and 8% *No*. These responses suggest an overall favorable view of AI-assisted learning, with more than three-quarters of respondents acknowledging its positive impact, albeit with caution.

Faculty in the UCLA survey were similarly divided: many recognized AI as a *productivity enhancer* and *language-learning support*, yet voiced concern about *academic integrity* and *skill erosion* (Williams, 2024; Dawson et al., 2024). The ambivalence mirrors what Xie and Korkmaz (2022) describe as the "dual perception" of AI, both empowering and potentially de-skilling if used uncritically.

Pedagogical Implications.

To balance innovation and integrity, ELTS guidelines should promote transparent and critical AI literacy:

- Encourage students to disclose AI use in submissions and reflect on its influence.

- Train instructors to design *AI-resilient tasks* (e.g., personal reflection, oral defense, creative synthesis) that privilege original thinking.
- Establish departmental statements clarifying acceptable AI support editing, translation, or idea generation—consistent with UCLA's Academic Senate policies.

In line with Turnbull et al. (2022), AI integration should be viewed as an opportunity to cultivate *digital discernment*, not merely as a technical adaptation. By embedding reflective AI use into the curriculum, UCLA can foster both ethical awareness and digital fluency.

Question 25 – "Do You Believe Online Teaching Will Become a More Prominent Part of Higher Education in the Future?"

With a modest sample (N = 23), participants in your survey expressed cautious optimism: 47.83% said "A little," 34.78% "Yes," 13.04% "No," and 4.35% "Very much." The average response of 2.30 on a 4-point scale (SD ≈ 0.75) suggests moderate expectations for VR and online teaching expansion in distance learning—though given the small N, these findings should be interpreted with caution.

This tempered optimism resonates with the faculty survey, where professors predicted *incremental but sustained integration* of online modalities within hybrid frameworks (Turnbull et al., 2022). Vlachopoulos (2024) and Dawson et al. (2024) both noted that the post-pandemic normalization of blended learning has reshaped institutional expectations: online delivery is no longer a contingency but a strategic pillar. Nevertheless, as Blundell et al. (2020) emphasized, adoption depends on *faculty support, student readiness,* and *infrastructural investment*—variables that require continued institutional monitoring.

Implications for Teaching Guidelines.

ELTS should align its pedagogical planning with a *hybrid-forward strategy*:

1. Systematically evaluate which course components yield the greatest learning value online versus in person.
2. Incentivize faculty to pilot blended delivery models with structured evaluation cycles.
3. Maintain departmental support for digital infrastructure, including captioning, LMS analytics, and media repositories.

In the long term, online teaching's prominence will depend on UCLA's ability to maintain *parity of quality*—ensuring that digital delivery is pedagogically intentional rather than administratively convenient.

Across these final items (21-25) , students reveal both *realistic expectations* and *adaptive readiness* for the evolving digital landscape. They appreciate online learning's flexibility and inclusiveness (Q21), yet recognize the self-regulation challenges that accompany it (Q22). They advocate for *authentic assessments* (Q23) and responsible use of *AI tools* (Q24), while expressing measured confidence in the ongoing expansion of digital higher education (Q25).

The correspondence with faculty perspectives is striking: both populations emphasize *design coherence, ethical innovation,* and *pedagogical intentionality* over technological novelty. Turnbull et al. (2022) and Vlachopoulos (2024) remind us that sustainability in online learning derives from continuous feedback between instructors and students—a dialogue this survey makes visible.

Unified Implications for teaching Guidelines:

1. Institutionalize *multi-modal participation and equitable engagement*.
2. Scaffold *time management* through structured pacing and mentoring.
3. Prioritize *authentic assessment* emphasizing production, reflection, and peer interaction.

4. Establish *AI literacy* frameworks to guide ethical integration.
5. Adopt a *hybrid-forward model* ensuring balance, flexibility, and inclusivity.

Together, the UCLA ELTS student and faculty surveys form a dual diagnostic instrument. They not only document perceptions but chart a roadmap for the department's next generation of online teaching standards—anchored in evidence, shared experience, and pedagogical integrity.

CHAPTER IV

Faculty Perspectives on Distance Learning : A Survey at UCLA ELTS

Context and Purpose

This chapter reports the findings from a department-level survey of instructional staff (professors and lecturers) in the Department of European Languages and Transcultural Studies (ELTS) at UCLA. The instrument was administered via Qualtrics to faculty via email; responses were anonymous. UCLA's Office of the Human Research Protection Program (OHRPP) and the General Campus IRB approved the study in accordance with the institution's human-subjects protocols. Because our design is cross-sectional and observational, we do not make causal claims; instead, we interpret the patterns of responses and relate them to extant theory and evidence in online higher education in the U.S. Even without causal inference, interpretive analysis is valuable. It surfaces local constraints, reveals misalignments with pedagogical best practices, and suggests high-leverage interventions (e.g. improved feedback cycles, LMS optimizations, targeted faculty development). In this work, the survey functions as a design needs assessment: it informs departmental online teaching guidelines and helps generate hypotheses for future pilots or quasi-experimental studies. Our interpretations avoid overreach; instead, they ground practical planning in empirically informed reasoning. The data analyzed will be considered in the design of online higher education teaching.

Why Faculty Perspectives Matter

In online and hybrid higher education, student learning quality depends heavily on meso-level design decisions: how activities are sequenced, how interactions are structured, how assessments are administered, and how LMS affordances align with pedagogical goals. Because faculty make or mediate these design choices, their readiness, beliefs, and perceptions play a pivotal role in whether evidence-based practices are adopted and sustained (Lim et al., 2023; Blundell, Castañeda, & Lee, 2020). Faculty surveys are more than opinion polls: they serve a diagnostic function, identifying institutional levers such as training needs, assessment redesign, and LMS integration that are likely to have the greatest impact (Turnbull, Chugh, & Luck, 2022; Fernández-Batanero et al., 2022).

Design and Participants

We developed 20 survey items grounded in the e-teaching literature and informed by direct observation of UCLA ELTS online and hybrid language courses. Forty-six instructors responded to most items (with small variation in item-level counts). The items (Q1–Q20) are organized into eight thematic domains:

- Modality preference and perceived learning (Q1–Q4)
- Technology readiness and usability (Q5–Q6)
- Teaching practices and tool ecosystems (Q7–Q8)
- Challenges (Q9)
- LMS importance and features (Q10–Q11)
- Support needs (Q12)
- Assessment and academic integrity (Q13–Q16)
- Future-facing perspectives (AI, VR, etc.; Q17–Q20)

Each item was designed to operationalize well-established constructs. For example:

- Design coherence and scaffolding of activities (e.g. sequence, transitions) draws on frameworks of presence and cognitive load (Fernández-Batanero et al., 2022).
- Feedback timing, clarity, and usability build on findings about the strong effects of feedback in online learning (Cavalcanti et al., 2021).
- LMS interoperability, feature sprawl, and governance issues tie into the institutional complexity of LMS ecosystems (Turnbull, Chugh, & Luck, 2022)

- Assessment restrictions aligned with learning objectives and proportions of proctoring align with integrity considerations in online assessment literature (Fernández-Batanero et al., 2022).
- Technology readiness and support needs reflect known determinants of sustained adoption (Lim et al., 2023).

Analytic Strategy

Our analysis proceeds in two stages for each item cluster:

1. Descriptive summary (counts, percentages, means, and standard deviations where applicable).
2. Interpretive linkage to the relevant literature, limited only to sources that directly address the construct (for example, LMS governance for LMS items, feedback theory for feedback items, online readiness literature for technology items).

This descriptive-analytic approach is standard in evaluation and organizational research; its strength lies in comprehensive coverage of decision-relevant domains, while its limitations are managed by transparency and careful alignment with prior work (Creswell & Creswell, 2018; Turnbull et al., 2022).

We retained the exact wording of each survey item. For multi-select questions, we report the percentage of selections (i.e. relative salience) rather than respondent-level frequencies; where a question required choosing multiple options, we note that response spread can bias toward moderate choices. Where relevant, we situate item interpretations in the discipline of language teaching and the specific context of ELTS (e.g. discussion-based seminars, language pedagogy).

Ethical Oversight and Scope

The study received IRB approval via UCLA's OHRPP. We collected no personal identifiable data. Because our sample is from a single department and participation was voluntary, we avoid overgeneralization and do not claim causation. Rather, our conclusions focus on methodological insight and actionable guidance aligned with disciplinary evidence (Fernández-Batanero et al., 2022; Turnbull et al., 2022; Lim et al., 2023; Blundell et al., 2020).

SURVEY DATA ANALYSIS

Theme A — Modality Preferences and Perceived Effectiveness (Q1–Q4)

Question 1 - Do you prefer teaching online compared to traditional in-person teaching?

Preference tilts toward in-person teaching. In our data, 39.13% selected "Somewhat prefer in-person," 15.22% "Strongly prefer in-person," 32.61% were neutral, and 13.05% preferred online to some degree (N = 46; M = 3.52; SD ≈ 0.99). Preference clearly tilts toward in-person teaching: 39.13% "somewhat prefer in-person" and 15.22% "strongly prefer in-person," for 54.35% total; 32.61% are neutral; only 13.05% prefer online to any degree (N = 46; M = 3.52; SD ≈ 0.99). This pattern aligns closely with the 2023 EDUCAUSE faculty report (Muscanell, 2023), where a slim majority of U.S. instructors (53%) prefer to teach on-site, compared with 20% who prefer hybrid and 18% fully online; the report also notes that faculty generally judge teaching and learning outcomes to be best on-site (e.g., connection with students, engagement, and perceived teaching quality) relative to hybrid or fully online formats (on-site ≈ 91% "feel connected" vs. 39% online; on-site ≈ 83% "best quality of teaching" vs. 43% online). My proportions, therefore, mirror the current U.S. landscape and help explain the central tendency in my mean score (Muscanell, 2023).

The sizeable neutral group in my data (32.61%) is also consistent with post-pandemic "situational preference": many faculty are open to non-in-person modalities where they afford flexibility or fit the task, but still perceive in-person as stronger for real-time engagement and "reading the room." The survey reported by Muscanell (2023) explicitly attributes online/hybrid preference to flexibility and existing course preparation and support (instructional design and technology), while on-site preference is tied to community, immediacy, and ease of gauging understanding, precisely the dimensions my respondents appear to privilege.

For course and policy design, these convergences point to two priorities if online formats are to be adopted without eroding perceived quality. First, design should lean on presence and interaction (structured synchronous discussions, quick feedback cycles, collaborative case work), since faculty evaluations of online effectiveness improve when activities are interactive and time-bound. Recent U.S. evidence from a study of faculty and students supports this emphasis on synchronous, interaction-rich online practices (Watson et al., 2023). Second, institutional scaffolding matters: time to prepare, access to instructional design, and reliable technology support are strongly associated with more positive experiences when faculty teach in non-preferred modes; online teaching guidelines, therefore, should highlight workload-aware timelines and embedded design support as enabling conditions for quality online delivery (Muscanell, 2023).

Comparable evidence from Italy confirms that post-pandemic faculty attitudes also lean toward in-person teaching but recognize a pragmatic role for digital and blended formats. The *Teaching4Learning@UNIPD* initiative at the University of Padova, an institutional program supporting faculty development and the use of innovative teaching methods, has monitored professors' perceptions of blended and online instruction since 2020. Reports from this program indicate that, although most Italian faculty have returned to in-person teaching as their primary mode, many continue to integrate online components for organizational flexibility, asynchronous activities, and student collaboration (University of Padova, 2024).

Similarly, a recent *BMC Medical Education* qualitative study (Casacchia et al., 2025) found that Italian university program leaders in health professions described remote online teaching as largely abandoned once restrictions ended, yet still valued for specific purposes such as international collaborations, administrative coordination, and content sharing. This pattern mirrors the pragmatic stance observed in Padova's reports: online teaching is not viewed as an equivalent alternative to in-person modes, but as a supplementary tool to support efficiency and access.

Taken together, both the U.S. and Italian data reveal that faculty overwhelmingly perceive in-person teaching as the pedagogical gold standard, especially for relational and interactive learning. However, the Italian evidence emphasizes a contextual and instrumental acceptance of online modes seen as functional additions rather than substitutes, while U.S. instructors tend to frame online effectiveness as contingent on design quality and institutional support. The difference suggests that while both systems converge on valuing face-to-face engagement, American discourse highlights how to make online work, whereas Italian perspectives emphasize when it is appropriate to use it.

Question 2 - Do you agree that students learn almost the same online as they do in person?

What the responses show.

The modal option was conditionality: 36.96% selected *"It depends on methods and technology."* An equal share (36.96%) disagreed that students learn "almost the same," 8.70% agreed, and 13.04% selected *"Don't know"* (N = 46; M = 3.98; SD ≈ 1.34). These results suggest that respondents view learning outcomes as design-contingent rather than modality-contingent. This interpretation closely aligns with pedagogical analyses emphasizing that the effectiveness of online university teaching depends less on delivery mode and more on the quality of instructional design particularly teacher presence, coherent structure, purposeful interaction, and timely feedback (Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2020). The implication for our data is straightforward: the question is not whether online learning *equals* in-person learning in the abstract, but whether a given online course implements the features that make learning comparable. Our colleagues' responses reflect precisely this position (Rapanta et al., 2020).

Recent empirical studies reinforce this nuanced view. Fireman et al. (2023) examined over 1,100 students in an undergraduate statistics course offered in parallel online and in-person formats, finding that online students performed *slightly better* on standardized exams, though the difference was small and not statistically significant. Their conclusion was that students can achieve equivalent learning outcomes online *when all other instructional elements are held constant*. Similarly, Busto, Dumbser, and Gaburro (2021) described a blended-teaching model in mathematics at the University of Trento during the pandemic: both students and instructors reported high satisfaction and perceived the blended format combining live streaming, interactive blackboard use, and recorded sessions, as superior to purely online teaching and effective in preserving learning continuity. The study did not directly compare blended to traditional in-person outcomes but highlighted that interactive structure and synchronous components are critical for maintaining perceived learning quality. At the same time, Italian qualitative evidence underscores contextual limits. Casacchia et al. (2025) found that, after the pandemic, most university program leaders in health professions returned to face-to-face formats, describing online teaching as useful only in specific circumstances such as international collaboration or content sharing. This mirrors broader faculty attitudes in Italy, where digital modalities are increasingly seen as complementary rather than equivalent to in-person instruction. Overall, both our survey and the cited studies converge on a single conclusion: learning outcomes depend on pedagogical design, not simply on mode of delivery. When online environments integrate clear structure, interaction, and presence, they can approximate in-person learning; absent those elements, parity diminishes. In practice, the debate is less about technological substitution than about how to design for meaningful engagement, regardless of setting.

Question 3 - Do you believe that distance teaching should be more widespread?

Among 41 respondents, conditional expansion dominated: 46.34% endorsed *"Only when students can't attend in person,"* 34.15% *"Only for certain classes,"* 12.20% *"Yes,"* and 7.32% *"No"* (M = 3.02, SD ≈ 0.95). These results reveal a clear orientation toward situational rather than generalized acceptance of distance teaching. In essence, most faculty members endorse online instruction only under specific conditions—either as a solution to accessibility constraints or for classes whose content or pedagogical format naturally lends itself to online or hybrid delivery. This pattern suggests a broad desire to preserve the primacy of in-person teaching, particularly for activities requiring dynamic interaction, immediate feedback, and embodied communication.

Empirical research supports this caution. Faculty perceptions of online instruction often reflect concern about the erosion of social presence, the sense of interpersonal connection and immediacy that underpins teaching and learning (Z.Yan & Pourdavood, 2024). Other studies highlight difficulties in sustaining engagement, ensuring prompt and personalized feedback, and fostering community among students (Xie & Korkmaz, 2022). The reluctance to expand distance teaching further stems not only from pedagogical reservations but also from the conditions of adoption: instructors who enter online teaching without adequate design support or institutional scaffolding typically report lower expectations of success and higher stress (Sims & Baker, 2021). Even when technological tools function effectively, the absence of structured pedagogical frameworks can make online delivery feel transactional rather than interactive, a tension reflected in many respondents' written comments.Italian evidence aligns closely with this nuanced skepticism. In the *Universi-DaD* study by Ramella and Rostan (2020), a nationwide survey of 3,398 Italian university professors and researchers, over half of respondents (54%) argued that distance teaching should not replace traditional instruction but could be integrated to enhance flexibility and accessibility. This position mirrors the conditional endorsements in the UCLA data: both groups appear to favor strategic, not systemic adoption of distance modalities. Importantly, Italian respondents emphasized that online teaching could improve access for working students and international participants but should not become the dominant paradigm of higher education.

The qualitative evidence deepens this perspective. Nirchi and Bianchi (2025) analyzed open-ended reflections from Italian faculty on emergency remote teaching (DaD) and found consistent references to reduced relational contact and interaction (cited by 43.4% of participants), greater organizational and technological demands, and difficulty receiving immediate feedback from students. The same respondents frequently described an increase in workload and a weakening of spontaneous dialogue with students. Their conclusion , that online instruction "cannot substitute in-person teaching" (*non può sostituire la didattica in presenza*), articulates a pedagogical boundary that Italian instructors are reluctant to cross.

Similarly, the Roma Tre report on *La didattica universitaria online ai tempi del COVID-19* (Biasi et al.2021) found that 69% of faculty believed remote instruction negatively affected the management of educational relationships, 73% reported an increased workload, and more than half (51%) said they would not wish to continue teaching entirely online. These Italian findings parallel the UCLA pattern of conditional support, but with a slightly different emphasis: Italian faculty tend to see blended and online modes as complementary extensions of the traditional classroom, whereas UCLA faculty appear more cautious, positioning them primarily as backup formats rather than coequal alternatives.

The distinction may reflect both cultural and institutional factors. Italian universities, particularly during the COVID-19 emergency, had to improvise large-scale distance systems with minimal infrastructure, which generated widespread reflection on pedagogy and the value of presence. As a result, Italian instructors often frame the debate in terms of *balance* and *integration*, how to combine modalities effectively, whereas the UCLA professors, operating within a mature digital environment, may be more focused on quality assurance and pedagogical coherence than on accessibility or innovation. This could explain why UCLA respondents exhibit a slightly stronger resistance to widespread distance expansion: their baseline for comparison is not the emergency transition but a pre-existing, resource-rich teaching environment. Taken together, these convergent data points suggest that both Italian and U.S. faculty see distance teaching as useful but limited, a pedagogical instrument rather than a replacement paradigm. Across contexts, professors underscore that quality hinges on design, support, and interactivity, not on modality alone. The difference lies in orientation: Italian educators often envision online teaching as a supplement for inclusivity and modernization, while UCLA professors view it more as a contingent accommodation for exceptional cases. Both positions reflect a shared principle: distance teaching should serve education's relational and cognitive goals, not redefine them.

Question 4 - Do you believe online teaching could be as effective as in-person classes if methods and technologies are improved?

The responses to this question suggest cautious optimism rather than firm conviction. Roughly forty-five percent of faculty members agreed, at least to some extent, that online instruction could reach the same level of effectiveness as traditional, in-person classes if supported by stronger methods and technologies. At the same time, about forty-one percent expressed some level of disagreement, while thirteen percent remained neutral (N = 46; M=2.93; SD ≈1.09). The pattern points to a kind of *conditional belief*: many respondents see potential for parity between the two modes, but only under specific conditions that address the known weaknesses of remote teaching. The predominance of "somewhat agree" answers captures the mood well—hopeful but tentative.

This balance between optimism and skepticism echoes what the literature has observed across higher education more broadly. Blundell, Castañeda, and Lee (2020) showed that instructors' sense of online teaching quality depends heavily on three interconnected factors: meaningful student–teacher interaction, the usability and reliability of technology, and tangible institutional support. Where these three conditions are in place, faculty tend to describe their online experience in positive terms. Where they are missing, doubts persist. Similar conclusions emerge from Xie and Korkmaz (2022), who found that an instructor's confidence in online teaching depends not just on tools but also on time, workload, and the presence of support structures that make the work sustainable. Sims and Baker (2021) add that, during emergency transitions, instructors who lacked design guidance and institutional backing often reported lower expectations of success, an experience that seems to inform the skepticism visible in my own data.

The Italian evidence tells a parallel but slightly different story. The Universi-DaD survey, a nationwide study conducted during the pandemic, found that most Italian academics did not reject online teaching outright but preferred it as a complement to face-to-face teaching rather than a full replacement (Ramella & Rostan, 2020). Faculty often emphasized that online tools could improve flexibility and access, particularly for students balancing work or distance, but warned that these benefits should not come at the cost of the interpersonal dimension that defines classroom teaching. Nirchi and Bianchi's (2025) analysis of open-ended responses paints an even more textured picture: many Italian instructors spoke of the *loss of relational contact*, the difficulty of maintaining spontaneous dialogue, and the frustration of delayed feedback. Their conclusion, that online teaching “cannot substitute in-person teaching”, summarizes what many expressed: digital modes can supplement, but not replicate, the immediacy and human exchange of the classroom. The Roma Tre report (Biasi et al.2021) offers similar evidence, noting that a large majority of faculty felt that remote teaching strained the management of educational relationships and increased workload, even as some acknowledged its organizational advantages. Most wanted to keep certain online elements—recorded lectures, for instance, but reintegrate them within a face-to-face framework once conditions allowed.

Quantitative studies reinforce this nuance. Ceravolo et al. (2023) found that although access to teaching materials and platforms remained stable in Italian universities, more than half of surveyed instructors struggled to translate practical or laboratory activities into an effective online format. When viewed alongside the UCLA data, these Italian findings underscore a shared sensibility. Both groups of faculty are willing to believe that online learning *could* reach comparable levels of effectiveness, but only if pedagogy, support, and technology come together in the right way. The difference lies in emphasis. UCLA professors seem to imagine online teaching as a *fallback option*, an acceptable alternative under ideal conditions but not a preferred one. Italian academics, reflecting on their collective experience with “Didattica a Distanza,” tend to describe online teaching as *complementary*, something that, if thoughtfully integrated, can enrich but not replace the traditional format. Both perspectives converge on one essential truth: better technologies alone will not guarantee success. What makes equivalence possible is not the platform, but the design, the way it enables presence, dialogue, and connection between teacher and learner.

Theme B — Technology Readiness and Usability (Q5–Q6)

Question 5 - Are you satisfied with the available technology and software for remote teaching?

The dominant response was "They can be improved" (65.22%), followed by "Somewhat satisfied" (23.91%), "Yes" (6.52%), and "No" (4.35%) (N=46; Mean=2.67; SD≈0.66). On balance, faculty are not rejecting the current stack so much as signaling conditional satisfaction: basic functionality exists, but usability, fit-for-purpose, and day-to-day reliability fall short of what instructors need to deliver high-quality online teaching at scale.

How to read this pattern (technology as an enabler when readiness and support are present).

Faculty literature consistently shows that technology matters most when it reduces friction and amplifies pedagogy not merely when new tools are available. Still in the multi-institutional survey of Blundell et al., 2020, instructor satisfaction was strongly associated with the role of technology, student–instructor interaction, and institutional support . In other words, when platforms are reliable and usable, when they support rich interaction, and when responsive institutional help is present, faculty report better experiences. A complementary line of work demonstrates that technology acceptance hinges on perceived usefulness and ease of use, together with visible support and realistic workload expectations. A synthesis of empirical studies organized with the Technology Acceptance Model shows that faculty adoption and satisfaction are closely tied to user-friendliness, technical support, and workload manageability classic usability and support concerns rather than "more tools" rather than simply adding more tools (Wingo, Ivankova, & Moss, 2017). This aligns with our Q5 distribution: a majority perceive room to improve rather than a need for wholesale replacement. Most important for interpreting Q5, readiness, not just tool availability, predicts instructors' satisfaction and confidence. In a multi-university analysis of instructors' emergency online teaching, pedagogical and online communication readiness significantly and positively predicted instructor satisfaction and confidence, whereas “technological readiness” alone was not the strongest lever (Lim, Abbasi, Pham, & Salahuddin, 2023). This reframes “technology” as support for presence, feedback, and orchestration (e.g., friction-light LMS navigation, communication tools that enable momentum), rather than as an end in itself (Lim et al., 2023).

Implications for Online teaching :

- We shoud treat the Q5 majority (“they can be improved”) as a readiness signal: prioritize usability (reduce clicks, simplify workflows), integration (coherent toolchains for feedback, scheduling, breakout work), and timely support (real-time help, short guides) (Blundell et al., 2020).
- Instructors shoud invest time in production-oriented professional learning that targets pedagogical and online-communication skills (e.g., structuring synchronous touchpoints, feedback cadences, discussion facilitation), since these are the readiness dimensions most associated with higher satisfaction and confidence (Lim et al., 2023).
- Teaching online should prioritize perceived usefulness and ease of use in platform decisions and rollout (co-design with faculty; remove known friction points), because these factors shape adoption and sustained use (Wingo et al., 2017).

Crucially, nothing in Q5 argues for throwing out platforms wholesale. The pattern points to targeted improvements, usability, integrations that support interaction, and embedded support coupled with pedagogy-oriented faculty development—which is consonant with the strongest faculty-focused evidence (Blundell et al., 2020; Lim et al., 2023; Wingo et al., 2017).

Question 6 - How difficult or easy is it to use remote learning technology (e.g., computer, video conferencing tools, online learning software)?

Perceived ease of use is essentially split: 45.65% "Easy," 4.35% "Very easy," 47.83% "A little difficult," and 2.17% "Difficult" *($N = 46$; $M = 2.48$; $SD \approx 0.62 \rightarrow SD$ approximately 0.62).* About half the respondents find the technology straightforward, while the other half experience friction. The concentration in the "somewhat" categories suggests conditional usability rather than a simple success/failure story, consistent with departments where faculty have mixed levels of experience, support, and training (Wingo, Ivankova, & Moss, 2017). The Q6 responses suggest focusing on capacity-building rather than switching platforms. In practice, that means targeted improvements to simpler LMS workflows, better integrations so instructors aren't app-hopping, and short, hands-on support during real course builds which the faculty literature links to better experience and higher uptake (Wingo et al., 2017; Blundell et al., 2020; Lim et al., 2023; Lloyd et al., 2012). Faculty literature indicates that ease of use is not only a property of the tools but a function of context notably instructional support, workload expectations, and prior preparation for online teaching. The multi-institutional survey of Blundell and collegues pointed out that online instructors found that the role of technology, together with instructor–student interaction and institutional support, are the primary drivers of instructor satisfaction (Blundell, Castañeda, & Lee, 2020). Where platforms are reliable and usable and are supported by responsive institutional help, faculty report better experiences; where these conditions are thin, usability problems surface (Blundell et al., 2020).

The synthesis of 67 empirical studies by Wingo et al., (2017) using the Technology Acceptance Model shows that faculty adoption and satisfaction turn on perceived ease of use, perceived usefulness, technical support, and workload manageability—that is, reducing friction in everyday workflows matters more than "adding more tools" . In practical terms, the "half-easy

/ half-difficult" split in Q6 is exactly what we would expect when usability and support vary within the same unit (Wingo et al., 2017). Critically, readiness, especially pedagogical and online communication readiness, predicts instructors' satisfaction and confidence more strongly than "technology familiarity" alone in emergency online contexts (Lim, Abbasi, Pham, & Salahuddin, 2023). That is, faculty who feel prepared to design communicative, well-structured online experiences report greater confidence and satisfaction, which in turn shapes whether they perceive tools as "easy" (Lim et al., 2023). Q6 therefore reads less like a referendum on brands and more like a map of capacity differentials inside the department. Older but still widely accepted work on faculty-perceived barriers underscores the same point: time costs, insufficient training, and limited institutional scaffolding frequently convert otherwise adequate technologies into difficult ones (Lloyd, Byrne, & McCoy, 2012). Usability, in other words, is situated it grows when support and workload are managed, and shrinks when they are not (Lloyd et al., 2012).

Implications for practice:

Focus on capacity, not platform swaps. Q6 points to targeted improvements that make existing tools easier to use in real courses.

1. Instructors should offer hands-on support while they're are building actual modules, exemplars, reusable templates, and short iterative feedback cycles. This approach builds workflow fluency and makes the same tools feel easier in practice (Baran, Correia, & Thompson, 2011; Baran & Correia, 2014), and it aligns with evidence that readiness in pedagogy and online communication, more than tool familiarity alone, drives satisfaction and confidence (Lim et al., 2023).
2. Reduce tool sprawl and anchor activity in LMS-centered integrations so routine actions (submissions, feedback, discussions) require fewer steps. Streamlining improves perceived ease of use and workload manageability, both of which are tied to faculty

acceptance and satisfaction (Wingo, Ivankova, & Moss, 2017; Blundell, Castañeda, & Lee, 2020).

3. Make support timely and visible. “Ease of use” improves when problems are resolved quickly and help is easy to find. Multi-institution work links institutional support to higher satisfaction (Blundell et al., 2020), while barrier studies show that thin or hard-to-access support amplifies difficulty (Lloyd, Byrne, & McCoy, 2012). Build responsive help channels and just-in-time micro-guides to move “a little difficult” toward “easy.”

Taken together, these steps treat usability as a property of design, integration, and support, not merely of the tools themselves (Wingo et al., 2017; Blundell et al., 2020; Lim et al., 2023; Lloyd et al., 2012).

Theme C — Teaching Practices and Tool Ecosystems (Q7–Q8)

Question 7 - Which of the following activities do you most frequently carry out while teaching online? (Please select at least 4)

The most frequently selected activities were teacher-to-student videoconferencing (23.95% of selections), online debates (20.96%), and digital-board activities (17.96%); chat-based Q&A (10.78%) and task submission followed; recorded lectures and project guidance were less frequent (multi-select; total selections=167). Because respondents could choose multiple activities, these percentages index the share of selections, not the share of faculty or the share of class time. The pattern nonetheless suggests that live interaction anchors instruction in ELTS’ online courses, which is unsurprising for discussion-centric language, literature, and culture teaching. Synchronous emphasis aligns with faculty reports that live video supports social presence, immediacy, and rapid formative feedback, advantages instructors often cite for discussion-heavy courses (Lowenthal, West, Archambault, Borup, & Belt, 2021; Wang, 2023). From a design standpoint, privileging live talk and real-time facilitation fits current practice provided it is staged within a broader sequence. Longstanding evidence shows that synchronous and asynchronous modes afford complementary functions: live sessions are strong for momentum, clarification, and community; asynchronous work is strong for preparation, reflection, and deeper processing (Hrastinski, 2008). More recent work formalizes this as bichronous design: an intentional blend in which pre-class micro-activities prime concepts, live sessions orchestrate interaction, and post-class tasks consolidate learning (Martin, F., Kumar, S., Ritzhaupt, A., & Polly, D. (2024). Your activity profile, heavy on live debate and board work, fits the middle component of this sequence; the underuse of recorded mini-lectures and structured project guidance signals room to strengthen the *before* and *after* layers. (Hrastinski, 2008; Martin et al., 2024).

Design implications

- Stage live work inside a bichronous arc. Precede videoconference debates and board work with short, focused asynchronous priming (micro-lectures, guided notes) and follow with targeted consolidation (retrieval practice, reflective writing, project milestones). This treats synchronous time as a culminating event rather than the sole locus of learning (Hrastinski, 2008; Martin et al., 2024).
- Make interaction protocols explicit. In live sessions, support equitable participation and reduce extraneous load with clear roles, turn-taking, and prompt structures, practices faculty identify as central to productive synchronous discussion (Lowenthal et al., 2021; Wang, 2023).
- Extend presence between sessions. Incorporate asynchronous video or text-rich feedback to sustain guidance and social presence after class; evidence links these practices to stronger perceptions of instructor presence (Borup et al., 2012; Borup et al., 2014).
- Keep the collaborative whiteboard, but scaffold it. Use worked examples, layered canvases, or structured templates to focus cognitive resources on meaning and language use rather than on tool mechanics (Reguera et al., 2021; Wang, 2023).

Question 8 - Which of the following software do you use during online classes? (Please select all that apply)

In a multi-select item *(total selections = 91; N = 46)*, choices clustered around general-purpose utilities and targeted interaction/assessment tools: PDF readers accounted for 38.46% of selections and presentation software (e.g., Prezi/PowerPoint) 17.58%, while Socrative (12.09%) and Kahoot! (8.79%) led among purpose-built engagement tools; several niche applications saw minimal use. Because respondents could select more than one option, these percentages index the share of all selections rather than the share of instructors or class time.

Taken together, the pattern is consistent with a mature LMS-centered ecosystem in which instructors rely on the LMS + conferencing platform for core workflows (content delivery, assignments, grading, discussion) and layer on a small number of specialized tools when they add clear pedagogical value (e.g., quick checks for understanding, game-based review). This is coherent because at UCLA, professors use Bruin Learn, which is a dedicated learning management platform built on Canvas by Instructure, customized with campus-specific integrations and branding. At the institutional level, this approach aligns with work on LMS governance and policy, which emphasizes that learning environments are complex techno-social systems requiring explicit policies for accounts, roles, support, usage, ownership, and protection policies that help avoid ad-hoc proliferation and keep practices coherent (Turnbull, Chugh, & Luck, 2022). On the integration side, interoperability standards notably Learning Tools Interoperability (LTI 1.3/LTI Advantage) exist precisely to make this "selective augmentation" workable: they allow third-party tools to plug into the LMS with single-sign-on, secure data exchange, and grade return, reducing duplicate logins and clicks and keeping assessment/feedback inside established workflows (EDUCAUSE, 2019).

When such standards are used, the same few tools can do more work, and the LMS remains the system of record rather than a jumping-off point into a tangle of apps. A broader comparative review of LMS implementation also cautions that diverse deployment patterns, cultural expectations, and local constraints shape which add-ons are actually adopted and sustained (Turnbull, Chugh, & Luck, 2022). In practice, institutions that standardize on a small, vetted set of integrations and communicate clear roles/processes for support tend to avoid "tool sprawl" while still enabling discipline-specific innovation. Faculty adoption literature shows instructors are more likely to use tools they perceive as useful and easy to use and for which training and support are visible (Fathema, Shannon, & Ross, 2015). The relatively modest use of external assessment/feedback tools can be explained by the fact that Bruin Learn (UCLA's Canvas-based LMS) includes UCLA-configured, built-in tools for grading and feedback**,** which keep score entry and instructor comments inside the platform**.** Within Bruin Learn, enabling grade passback and rubric-based feedback via LTI can further concentrate instructors' work in the LMS, typically improving perceived ease of use and reducing context switching. This approach aligns with LMS policy research that highlights integrated assessment/feedback workflows as a hallmark of mature institutional practice, and with interoperability standards that support automatic grade return and embedded comments (Turnbull, Chugh, & Luck, 2022).

Theme D — Challenges in Online Classes (Q9)

Question 9 - What are the major challenges with online classes? (Please select at least 4)

Top challenges in our sample were student isolation (24.85% of mentions), lack of interaction (19.39%), distractions (15.76%), and lack of student motivation (13.33%). Technical issues (1.82%) and time management (0.61%) were far less selected (multi-select; total mentions = 165).

This question is critical, and the pattern of responses aligns closely with what the literature in online higher education has repeatedly flagged. That student isolation claims the largest share of mentions suggests faculty see it as a composite symptom—one that encapsulates deeper tensions in interaction quality, motivational dynamics, and community formation. Because respondents were forced to choose multiple challenges (a check-all format), these percentages reflect relative salience rather than absolute prevalence; so it is natural that an umbrella challenge like isolation outranks more specific drivers like interaction or motivation. Social presence theory holds that feeling "seen" and connected undergirds student satisfaction and perceived learning (Garrison, Anderson, & Archer, 2000; Richardson, Maeda, Lv, & Caskurlu, 2017). In faculty studies, synchronous video and live sessions can help establish immediacy and presence but only if they are scaffolded, consistent, and supported over time (Lowenthal, et al.2021). In that light, isolation is what emerges when interaction is patchy, feedback is infrequent, or students lack opportunities to engage beyond superficial exchanges. The second element lack of interaction (19.39%) is precisely the kind of gap many online instructors worry about. Real-time exchange is harder to sustain remotely without well-designed protocols (turn-taking, scaffolding, prompts) and a mix of synchronous + asynchronous modalities (Lowenthal et al., 2021; Hrastinski, 2008). That said, interaction is rarely "absent" entirely, it is often *uneven*, dependent on instructional design rather than hardware constraints.

Distractions (15.76%) map onto the known issue of extraneous cognitive load in online settings: toggling between apps, notifications, multitasking, and fragmented attention can reduce focus on the learning goal. Strategies like segmenting content, signaling key points, and limiting extraneous toggles are well documented in design research (e.g. Mayer & Moreno, 2003) and seem well matched to this mid-tier selection.

Motivation (13.33%) is more subtle it is affected by autonomy, perceived competence, and relatedness (from Self-Determination Theory). Online course designs that allow structured choice, clarity of assessment, regular presence, and scaffolding tend to support effort and sustained engagement (Deci & Ryan, 2000; Broadbent & Poon, 2015). The fact that motivation is lower on the list seems consistent with its dependence on the relational elements captured under “isolation.” As for Casacchia et al. (2021), their Italian survey of university faculty during COVID-19 found that instructors report substantial technical, pedagogical, and psychological difficulties with distance education; they emphasize that the most significant disadvantage is the loss of relational and reflective exchanges with students.

To mitigate isolation, online class design should foreground sustained presence and structured interaction:

- Plan synchronous sessions with explicit roles, guiding prompts, and equitable talk distribution (brief input → small-group work → plenary synthesis) (Lowenthal et al., 2021).
- Extend instructor presence between sessions with concise, rubric-based feedback and short audio/video replies (e.g. 60–90 second clips), which can increase perceived connection (Borup, West, & Graham, 2012).
- Use a bichronous approach: asynchronous preparation and consolidation around carefully timed synchronous segments so students can engage even if they miss live attendance (Martin et al. 2024).
- Assign consistent small teams or cohorts and make participation norms explicit—these help stabilize peer connections and counteract unpredictability (Garrison et al., 2000; Richardson et al., 2017).

Theme E — Learning Management System (LMS): Importance and Features (Q10–Q11)

Question 010 - How important is it to have a well-structured Learning Management System (LMS)?

A large majority of respondents (83%) rated a well-structured LMS as *Important* or *Very important* (N = 46; M = 2.13; SD ≈ 0.77). This is not a simple matter of convenience or aesthetics; it reflects a recognition that the LMS functions as the pedagogical backbone of online teaching and learning. When the system is well-organized and supported, both faculty and students can focus on learning rather than logistics. In contemporary online courses, the LMS serves as the system of record for content, activity sequencing, feedback, and communication. When it is reliable, coherent, and well supported, learners consistently report higher satisfaction and perceived usefulness, factors that predict engagement and persistence (Al-Fraihat, Joy, Masa'deh, & Sinclair, 2020). The Italian *Eurostudent Survey* confirms this relationship: in Spring 2020, more than 5,000 university students reported that their satisfaction with online classes depended primarily on the *organization and delivery* of lessons and on whether *functional, interactive digital platforms* were in place (Finocchietti, Garbato, & Pannone, 2020). In other words, the effectiveness of remote education in Italy hinged on the same structural qualities that UCLA instructors now identify as crucial, a dependable, coherent LMS ecosystem.

Comparing UCLA and Italian perspectives.

UCLA faculty's 83% endorsement of LMS importance aligns closely with Italian data. The Eurostudent Italy report demonstrated that satisfaction with online learning depended on *organizational clarity* and *functional digital platforms* (Finocchietti et al., 2020), while surveys at Modena–Reggio Emilia reinforced that well-structured course pages were vital for engagement and should remain post-pandemic (Russo et al., 2022). Similarly, Cofini et al. (2022) found that Italian students' stress and satisfaction levels during e-learning were directly linked to platform usability and support quality. Across both contexts, the message is consistent: a coherent, stable LMS is not an administrative detail but a pedagogical foundation, organizing content, streamlining feedback, and supporting engagement through reliability and clarity.

Key characteristics that matter most.

1. Clarity, reliability, and support. Clear navigation, consistent labeling, dependable performance, and responsive help services reduce friction for both instructors and students. In Al-Fraihat et al.'s (2020) model, these fall under *system quality* and *service quality*, both of which strongly influence satisfaction and perceived usefulness. Italian data echo these findings. In a large-scale study at the University of Modena and Reggio Emilia, students called for improvements in the *organization and layout* of course pages and explicitly requested that the online platform be *maintained* after the pandemic, underscoring its perceived value as a learning hub (Russo, Alboni, Morlini, Pavone, & Sartori, 2022).
2. Integrated assessment and feedback. A mature LMS integrates grading and commentary within a unified workflow. Interoperability standards such as LTI 1.3 and the Assignment & Grade Services specification (1EdTech Consortium, 2019) support secure launches, automatic grade return, and a substantial reduction in "app-hopping," thereby mitigating the risk of transcription errors and fragmentation of student feedback. This deep integration enables instructors to concentrate their evaluative comments where students actually encounter them, that is, within the native LMS environment.
3. Analytics that inform action. Since most learning activity occurs within the LMS, its log data can support learning analytics that identify disengagement early and inform targeted interventions. Ifenthaler and Yau (2020) reviewed this literature and found that LMS-based analytics can enhance study success when used ethically and designed with actionable feedback loops. Pan et al. (2024) further

show that interventions embedded in LMS analytics improve engagement and completion rates when coupled with student-facing dashboards.

4. Cognitive-load–aware design. LMS interfaces minimize unnecessary clicks, maintain consistent layouts, and use clear visual signaling reduce *extraneous cognitive load*, allowing students to focus on learning tasks rather than navigation (Skulmowski & Xu, 2022). Such design considerations are directly linked to better motivation and processing efficiency.
5. Governance and coherence. Institutions that treat their LMS as a strategic techno-social system, establishing clear governance on roles, data protection, and integration vetting, achieve higher trust and usability across stakeholders. Policies emphasizing "LMS-first" coherence help maintain predictability and user confidence (Turnbull, Chugh, & Luck, 2022).

Question 11 -Which LMS features are most important for effective online teaching? (Select up to 3)

"Integration with other tools" (33.05%) and "Easy navigation" (32.20%) topped the list, followed by assignment submission tools and feedback mechanisms (multi-select; total selections=118).

UCLA's academic staff emphasis on integration and easy navigation is consistent with policy analyses that call for coherent, standalone, and platform-neutral LMS governance to keep ecosystems usable and trustworthy (Turnbull, Chugh, & Luck, 2022). Complementing this, recent work on online assessment ecosystems highlights the benefits of LMS-integrated assessment and feedback such as grade passback and rubric workflows for reducing friction, concentrating instructor effort in one workflow, and improving adoption (Topuz, Saka, Fatsa, & Kurşun, 2022).

Theme F — Support Needs (Q12)

Qestion 12 - What type of support do you need most for online teaching? (Select up to 2)

When asked to select up to two types of support, respondents prioritized content-creation resources (37.66%) and student support services (23.38%), followed by pedagogical training (19.48%) and technical support (14.29%) (multi-select; total selections = 77). Because choices were capped at two, these percentages index relative priority rather than exclusivity: instructors expressed their ideas about what would help *most*.

1) Content-creation resources top the list (37.66%). Designing high-quality online materials (structured modules, activity prompts, assessments) is labor-intensive and requires both time and production know-how. Systematic reviews and expert syntheses from higher education underline that effective online teaching depends on purposeful activity design, strong teaching presence, and assessment refitting, all of which presuppose access to production support (templates, media, captioning, editing) rather than ad-hoc effort by individual instructors (Rapanta et al., 2020). In parallel, multivariate work on faculty satisfaction shows that technology and institutional support are core predictors of how positive instructors feel about their online teaching consistent with requests for concrete content-creation resources that lower the production burden (Blundell et al., 2020). Finally, studies of instructors' decision-making report that workload/time costs and available support shape whether and how faculty choose to teach online; easing the content-build bottleneck is therefore directly aligned with adoption (Xie & Korkmaz, 2022).

2) Student support services ranked second (23.38%). Why do instructors want this? Student success online hinges on multi-level support (institutional, course/subject, and peer). Qualitative evidence from higher education shows that students value timely, embedded support and that subject-level teacher support (clear guidance, feedback, check-ins) is often

the most consequential for engagement and retention yet it works best when complemented by institutional services (advising, academic skills, tech/help-desk) that are visible inside the LMS (Fan et al., 2024). Instructors' call for more student support is therefore coherent: strengthening those services reduces isolation/friction and makes the teaching effort "stick." (Fan et al., 2024).

3) Pedagogical training sits mid-pack (19.48%), but it is a high-leverage need.
Large-N analyses of online teaching readiness show that pedagogical and online-communication readiness are significant positive predictors of instructors' satisfaction and confidence with online teaching (Lim et al., 2023). In other words, targeted professional learning (how to design sequences, facilitate interaction, and give feedback online) pays off more than tool-tips alone. The fact that pedagogical training is not #1 here likely reflects the forced two-choice constraint: many instructors understandably reached first for "hands on the product" (content resources) and "more help for students," while still signaling that design-oriented PD matters. (Lim et al., 2023).

4) Technical support appears lowest (14.29%), but that doesn't mean it's unimportant.
Faculty surveys and syntheses consistently place institutional/technical support among the pillars of positive online teaching experiences (Blundell et al., 2020). Given the two-choice item, lower selection likely indicates that baseline technical support is adequate for many respondents compared with more pressing needs (content production; student services), not that tech support is irrelevant but this lower percentage comply with UCLA's well recognized technical support staff. The research base suggests keeping support timely and visible (clear help channels, just-in-time guides) as part of a broader readiness strategy. (Blundell et al., 2020; Lim et al., 2023).

Indications for online teaching guidelines

1. Provide templates, media kits, captioning/transcription, and light instructional-design **consults** embedded in real course builds. Offer small release-time or mini-grants for first-time online conversions. This directly targets the top-ranked need and aligns with evidence that technology/institutional support undergirds faculty satisfaction and uptake (Blundell et al., 2020; Rapanta et al., 2020).
2. Integrate student support services into the LMS workflow Surface advising, tutoring, writing support, early alerts, and mental-health resources in course shells (start-here modules; persistent side-panels; nudges tied to milestones). Encourage subject-level teacher presence (weekly announcements, quick check-ins) and connect it to centralized services so students experience a single support ecosystem. This combination is associated with higher engagement and retention (Fan et al., 2024).
3. Prioritize Professional Development on what matters most: pedagogy and online communication. Offer short, production-oriented short, hands-on training sessions on bichronous sequencing, discussion facilitation, feedback cycles, and rubric use, paired with micro-coaching during course builds. Prioritize practices that increase teaching presence and clear communication, given their predictive links to instructor satisfaction/confidence (Lim et al., 2023) and the design-first emphasis in the literature (Rapanta et al., 2020).
4. Keep technical support "close to the course." Maintain a responsive help channel (same-day replies on weekdays), curated how-to guides inside the LMS, and a playbook for common assessment flows (quizzes, grade passback, rubric feedback). Even if not top-ranked, visible, reliable support is a known component of faculty satisfaction and sustained adoption (Blundell et al., 2020).

Theme G — Assessment and Academic Integrity (Q13–Q16)

Question 13 - What types of assessments do you believe are most effective for online courses? (Select at least 3)

What the responses show.

Continuous assessment (26.96%) and essays/written assignments (23.48%) led; timed online exams (14.78%), presentations (10.43%), multiple-choice quizzes (10.43%), open-book exams (8.70%), and group projects (5.22%) followed (multi-select; total selections = 115). Reading the pattern with evidence we note that continuous assessment stands at the at the top (26.96%).This emphasis matches post-COVID syntheses showing that formative/continuous assessment supports engagement and learning online when it supplies frequent, low-stakes checks with explicit criteria and rapid feedback loops (Pillay, 2024). Related work frames continuous assessment as a way to lower stress and encourage distributed practice rather than a single high-stakes event (Rincón et al., 2024). In Italy, the fit with continuous assessment is *mixed by tradition*: universities historically privilege summative oral and written examinations scheduled at *"sessioni d'esame"*. During the pandemic, institutions issued emergency guidance to conduct assessments online (e.g., Politecnico di Torino and University of Milan guidelines) that did allow continuous elements (assignments, short quizzes) but typically anchored courses with an oral and/or written exam as the decisive measure of achievement (Politecnico di Torino 2020 ; Università di Milano 2020).

Essays/written assignments high (23.48%).

Constructed-response tasks are widely used to elicit explanation and transfer and are often preferred online when higher-order outcomes matter (Jones et al., 2024). Italian practice converges here: essays and written relazioni are familiar components within many courses, and Italian faculty used them extensively during the emergency period as less surveillance-dependent alternatives to proctored tests (UniMi 2020; PoliTo 2020).

Timed online exams (14.78%).

Recent taxonomies stress that validity online hinges on purpose-aligned restrictions (what info/tools/people are allowed) and clear communication of rules (Dawson et al., 2024). The Italian experience underlines an additional constraint: privacy and data-protection law. In 2021, Italy's Data Protection Authority found one university's remote proctoring system in breach and issued a fine, emphasizing proportionality and transparency requirements (EDPB news summary of the Italian SA decision). After the emergency, the Ministry of University and Research moved to require in-person exams in ordinary conditions, allowing exceptions only for emergencies or specific accommodations, while strengthening ANVUR oversight (MUR, 2024).

Presentations and group projects (10.43% and 5.22%).
These tasks fall under authentic assessment and map well to disciplinary practice (Vlachopoulos & Makri, 2024). They were widely adopted in Italy during "DaD" (distance teaching) for two pragmatic reasons: (1) they can be run with standard video tools (no invasive proctoring), and (2) they naturally reduce incentives for simple answer-copying. University guidelines catalogued oral presentations, viva-style colloqui, and supervised small-group work as acceptable online formats (Politecnico di Torino 2020; Università di Milano 2020).

Open-book exams (8.70%).

Empirical work in STEM indicates open-book formats can benefit lower-performing students when tasks require analysis/application rather than recall (Mizori et al., 2025). In Italy, open-book written "prova online" was explicitly permitted in many emergency rules, often paired with oral verification to check uthorship/understanding (PoliTo). This "written +

oral check" hybrid reflects a longstanding Italian reliance on oral assessment for integrity and judgment, now adapted to digital settings.

Multiple-choice quizzes (10.43%).

MCQs remain useful as low-stakes retrieval practice within a continuous-assessment scheme; recent experimental work suggests the format effect is smaller than the quality of prompts and alignment (van Wijk et al., 2024). In Italy, MCQ test banks were used online but often constrained by proctoring and privacy considerations; several universities recommended short, frequent quizzes plus follow-up oral checks rather than a single, high-stakes MCQ exam (UniMi; PoliTo).

Question 14 - How important is proctoring for online exams?

Most respondents rated proctoring Important or Very important (about 69.6%), with 30.43% Neutral and none selecting "Not important" ($N = 46$; $M = 2.26$; $SD \approx 0.53$). Read as a priority signal: instructors see proctoring as a key integrity safeguard for online tests, though a sizable neutral group suggests openness to how it is implemented (or to alternatives for some assessments). Survey syntheses indicate that self-reported cheating in online exams is non-trivial, which helps explain faculty support for proctoring as part of a broader integrity toolkit (randomization, item banks, restriction design). At the same time, evidence suggests proctoring mitigates but does not eliminate misconduct , hence the need to combine it with assessment design and clear rules (Han et al., 2024). Recent empirical comparisons find higher scores on unproctored exams than on proctored equivalents, compatible with increased access to unauthorized resources and/or reduced performance pressure, another reason instructors value proctoring for high-stakes tests (Chan et al., 2023).

A recent taxonomy of restrictions for online examinations (what information, people, and tools are allowed) reframes proctoring as one restriction among several that should be aligned with the construct being assessed. For some outcomes, open-book/open-web with tight time windows, application-focused items, and tool restrictions may be as, or more, valid than camera-based invigilation (Dawson et al., 2024).

Indications for E-teaching evaluation

Professors should reserve live or AI-assisted proctoring for high-stakes exams where unmonitored access would materially threaten validity (e.g., recall-heavy, easily searchable items). For lower-stakes checks, prefer design tactics (randomized item banks, application prompts, open-resource policies with time limits) (Dawson et al., 2024).
Universities should design the restriction set, then pick the tool; specify what information, people, and tools are allowed, and communicate this in the syllabus and exam header. Align restrictions to intended learning outcomes before selecting a proctoring modality (live, record-and-review, lockdown-only) (Dawson et al., 2024).
There should be a shift weight toward application-oriented items, case vignettes, and numerical variants; keep core tasks inside the LMS to limit app-hopping. This reduces incentives and opportunities to breach rules and narrows any performance gap between proctored and unproctored contexts (Chan et al., 2023).

Question 15 - What kind of proctoring do you prefer?

Preferences are distributed across live proctoring (36.96%), automated/AI proctoring (34.78%), and hybrid models that combine algorithmic flags with human review (26.09%); record-and-review is least favored *(N = 46; M = 2.59; SD ≈ 1.30)*. This pattern signals no single "winner," but a pragmatic stance that different exams call for different safeguards.

The split is consistent with recent reviews: live proctoring offers human judgment and real-time intervention, but at higher cost and logistical burden; automated systems scale well yet can produce false positives and heighten privacy/anxiety concerns; hybrid approaches aim to preserve scale while adding contextual judgment (Han, 2024; Marano et al., 2024).

Framed within current assessment guidance, proctoring is one element of the overall restrictions design (alongside rules about information, people, and tools). The practical takeaway is case-by-case selection: match the modality to the stakes, the construct being assessed, and the acceptable trade-offs (Dawson et al., 2024).

Taken together, these data and recent reviews point to a clear rule of thumb for e-learning courses: use live or hybrid proctoring for high-stakes, recall-heavy exams; for application-oriented tasks delivered under clear restriction rules and short time windows, prefer automated monitoring or no proctoring at all. In every case, offer a low-stakes practice run and provide transparent information about privacy and data handling (Han, 2024; Dawson et al., 2024; Marano et al., 2024).

Question 16 - What challenges do you face with online assessments? (Select all that apply)

The responses of professors and lecturers show that academic integrity concerns dominated (51.25% of selections), followed by student engagement (15.00%), providing timely feedback (12.50%), technical issues (11.25%), and grading consistency (10.00%) *(multi-select; total selections = 80)*. Because respondents could choose multiple options, these figures indicate relative salience (share of all selections), not the proportion of instructors nor time spent on each issue.

The emphasis on integrity is consistent with current guidance that treats proctoring and access controls as just one element of a broader restrictions design, clear rules about what information, people, and tools are allowed, aligned to the learning outcomes being assessed (Dawson et al.,2024). The mid-tier concerns point directly to the classic levers for online assessment quality: build authentic, iterative tasks to sustain engagement (Vlachopoulos & Makri, 2024) deliver fast, usable feedback via concise rubrics, exemplars, and short audio/video comments (Williams, 2024); keep the technical workflow reliable and LMS-integrated to reduce friction and improve grading consistency with analytic rubrics and periodic rater calibration (Topuz, Saka, Fatsa, & Kurşun, 2022)

As assessment is as important in university online courses as in traditional ones, teaching staff should anchor practice in validity first and apply integrity measures thereafter. They should begin by articulating the construct they intend to assess, then set explicit, coherent rules about what information, people, and tools are allowed; proctoring and technical controls should be chosen in proportion to actual risk, not by default (Dawson et al., 2024). With those guardrails established, professors should design for engagement by using authentic, staged tasks, case briefs, project milestones, disciplinary communications, that make students' effort visible and meaningful over time (Vlachopoulos & Makri 2024).

Feedback should be fast and findable: teaching staff should standardize concise rubrics and exemplars, add brief audio/video annotations where helpful, and schedule feed-forward checkpoints between submissions so students can act on guidance while it still matters (Williams, 2024). Operationally, instructors should keep the assessment workflow inside the LMS, assignments, quizzes, and grade passback, to reduce tool-switching; they should minimize plug-in sprawl and run a low-stakes practice test to surface technical issues early (Topuz et al., 2022). Finally, departments and co-teaching teams should safeguard grading consistency by adopting analytic rubrics, holding brief norming sessions, and conducting periodic spot-checks of inter-rater alignment each term (Lee, J. E., Recker, M., & Yuan, M. 2020).

Theme H — Improvement Priorities and the Future (Q17–Q20)

Question 17 - What improvements would you suggest for future online courses? (Select up to 3)

Responses show that improved course design standards led *(30.63% of selections)*, followed by better technology and tools *(18.92%)*, adoption of new methodologies *(18.92%)*, and more student support services *(15.32%)*

(multi-select; total selections = 111). Because respondents could choose up to three options, these figures indicate relative salience (percent of selections) rather than the proportion of instructors endorsing each option. The emphasis on design standards aligns with analyses arguing that effective online courses are built around clear teacher presence and purposeful learning-activity design, not merely tool availability (Rapanta, Botturi, Goodyear, Guàrdia, & Koole, 2020). In practice, standards make presence and pacing visible and repeatable: consistent module structures, transparent criteria, and scheduled feedback cycles turn good intentions into routines students can follow (Rapanta et al., 2020; Williams, 2024). The call for better technology/tools fits policy work showing that mature LMS ecosystems emphasize interoperability and coherent workflows rather than tool proliferation; integrations should keep assessment and feedback inside the LMS to reduce friction (Turnbull, Chugh, & Luck, 2022; Topuz, Saka, Fatsa, & Kurşun, 2022). Requests for new methodologies point to pedagogies that have shown promise online, e.g., authentic assessment and staged tasks that build higher-order skills and sustain engagement across time (Vlachopoulos & Makri 2024). Finally, student support services remain a critical layer: when advising, tutoring, and study-skills support are embedded in the course shell and coordinated with instructor presence, institutions see better engagement and persistence (Fan et al., 2024).

Question 18 - Do you believe online teaching will become a more prominent part of higher education in the future?

Data revealed a strong consensus among participants that digital learning will continue to expand. Among the 43 respondents, the mean score of 6.93 on a 9-point Likert scale (SD = 1.49) indicates broad agreement that online and hybrid modes are not a temporary adaptation but an enduring feature of higher education. This finding aligns with recent global enrollment data and institutional reports documenting the sustained growth of online learning worldwide.
In the United States, data from the National Center for Education

Statistics (NCES) show a pronounced structural shift. The percentage of postsecondary students enrolled in at least one online course rose from 36% in 2019 to a pandemic-driven peak of 75% in 2020, before stabilizing at 61% in 2021 and 53.2% in 2023 (National Center for Education Statistics, 2024; U.S. Department of Education, 2024). This sustained participation rate nearly double that of the pre-pandemic period confirms that online education has become embedded in institutional delivery strategies rather than serving as a contingency measure. Comparable patterns have emerged across other national systems. In the United Kingdom, Higher Education Statistics Agency data indicate that by the 2022/23 academic year, approximately 28% of postgraduate-taught students were enrolled in fully online programs (HESA, 2024). Germany's CHE Centre for Higher Education (2025) reports more than 250,000 distance-learning students, roughly 8–9% of total higher-education enrollment up significantly from the mid-2010s.Spain's National Distance Education University (UNED) is the largest university in the country; according to the Spanish Ministry of Science, Innovation and Universities, it enrolls more than 250,000 students in its official degree programmes, making it the principal provider of distance higher education nationally (Ministerio de Ciencia, Innovación y Universidades, n.d.).

The most dramatic growth has occurred in Brazil, where the Instituto Nacional de Estudos e Pesquisas Educacionais Anísio Teixeira (INEP, 2022) documented a 474% increase in distance-education entrants between 2011 and 2021 from 18.4% to 62.8% of all incoming students. By 2023, nearly half of Brazil's undergraduate enrollments were in online programs (INEP, 2023; Revista Ensino Superior, 2024). Similarly, in South Africa, the University of South Africa (UNISA) continues to serve over one-third of the nation's higher-education students through distance delivery (University of South Africa, 2023). In Italy, national higher-education statistics reveal a growing adoption of online modalities. Independent analyses (Minerva, De Santis, Bellini, & Sannicandro, 2024) confirm that Italy's online university sector driven by telematic universities such as Pegaso, eCampus, and UniMarconi, has seen an average annual growth rate exceeding 12% over the last decade. Emerging economies are driving significant growth in scale through large-scale national initiatives; the Asia-Pacific region is recognized as the fastest-growing regional market (Straits Research, 2024).

Question 19 - Do you believe that artificial intelligence will improve distance learning?

With a modest sample (N = 23), participants in the survey expressed cautious optimism about immersive technologies in education: 47.83 % selected “A little,” 34.78 % “Yes,” 13.04 % “No,” and 4.35 % “Very much.” The average response of 2.30 on a 4-point scale (SD ≈ 0.75) suggests moderate expectations for VR and metaverse integration in distance learning though given the small N, these results should be interpreted with caution. Such tempered optimism mirrors a broader academic consensus: virtual reality and related immersive environments hold promise for enhancing engagement and experiential learning, yet their success depends fundamentally on pedagogical design rather than technological novelty.
The American academic landscape, for instance, reflects a predominantly pragmatic and transformative approach. The prevailing idea is that AI is not merely an auxiliary tool but an agent of "augmentation" that fundamentally extends human and pedagogical capabilities. Among the most vocal proponents is Ethan Mollick of the Wharton School, who strongly advocates for integrating AI as a "co-pilot" (Mollick, 2023). This perspective shifts the educator's role from content deliverer to a designer of complex, authentic learning experiences, which are often impossible to scale without algorithmic assistance.

This viewpoint is reinforced by Justin Reich (MIT), who, while acknowledging the systemic failures often associated with educational technology (Reich, 2020), has detailed how AI and adaptive tools offer the *potential* to create truly personalized and effective learning pathways. This potential resides in the technology's ability to deliver the precise scaffolding necessary to balance the sensory richness of modern media with cognitive manageability, a key principle of the Cognitive-Affective Model of Immersive Learning (CAMIL) (Makransky & Petersen, 2021). However, the critical American and Anglophone front, while acknowledging the technology's inevitability, raises profound ethical and structural objections. Ben Williamson (University of Edinburgh) has intensified his critiques on the concept of "educational AI colonisation" (Williamson, 2022), arguing that reliance on digital platforms risks monopolizing educational governance and dictating pedagogical goals, thereby eroding institutional autonomy. Correspondingly, Neil Selwyn (Monash University) discusses the critical impact of AI on reducing student autonomy, warning that the passive acceptance of machine-generated feedback can diminish critical thinking and deep reflection (Selwyn, 2022).

In contrast, the cultural debate in Italy proceeds along different coordinates, characterized by a reflective, anthropocentric caution that elevates ethics, the human relationship, and cultural preservation. The prevailing Italian approach insists that AI must function as a technical instrument at the service of human and cultural growth. This stance is formally encapsulated in the MIM Guidelines (2025), which mandate transparency and prioritize concerns around equity and inclusion.

One of the most influential voices in this debate is Pier Cesare Rivoltella, whose reflections, developed jointly with Chiara Panciroli in *Pedagogia algoritmica* (2023) and in the essay *Collaborating with Machines. AI, Literacies, School* (2024) frame artificial intelligence through what they describe as a pedagogy centred on human agency. Their central warning is that uncritical trust in technological systems risks allowing algorithmic procedures to displace reflective and critical thinking, thereby weakening the *cura della relazione didattica*, the relational and ethical core of teaching that grounds any meaningful process of student formation. This position finds support in contemporary Italian influential thinkers such as Luciano Floridi (Università di Bologna) who contributes to the debate by advocating for a rigorous ethical framework, warning that AI development must be carefully managed to preserve the "human ecosystem" and the dignity of the learning process (Floridi, 2023). Consequently, the Italian context views AI as a force to be normatively governed, with cultural preservation taking precedence over mere efficiency optimization.

Question 20 - Do you believe that virtual reality and the metaverse will improve distance learning?

With a modest sample (N = 23), participants in the survey expressed cautious optimism about immersive technologies in education: 47.83 % selected “A little,” 34.78 % “Yes,” 13.04 % “No,” and 4.35 % “Very much.” The average response of 2.30 on a 4-point scale (SD ≈ 0.75) suggests moderate expectations for VR and metaverse integration in distance learning though given the small N, these results should be interpreted with caution. Such tempered optimism mirrors a broader academic consensus: virtual reality and related immersive environments hold promise for enhancing engagement and experiential learning, yet their success depends fundamentally on pedagogical design rather than technological novelty.

In higher education, immersive VR has demonstrated positive but design-dependent effects. Gains are most robust when learners must acquire procedural, spatial, or experiential skills domains such as laboratory practice, clinical training, or environmental fieldwork. A meta-analysis by Conrad, M., Kablitz, D., Schumann, S. (2024) converge on the conclusion that VR enhances knowledge acquisition, practical performance, and motivation, provided cognitive load is carefully managed. These studies also caution that usability, simulator sickness, cost, and unequal access remain persistent barriers to equitable implementation. The Cognitive-Affective Model of Immersive Learning (CAMIL) proposed by Makransky and Petersen (2021) helps explain the variability of outcomes. CAMIL posits that presence and agency core affective responses in immersive environments can heighten motivation and engagement, yet learning improves only when instructional scaffolds balance sensory richness with cognitive manageability. Excessive perceptual stimulation or inadequate guidance can overload working memory, diverting attention from the target content. Thus, immersion must be pedagogically orchestrated so that emotion and embodiment serve learning rather than distract from it.

Recent work by Jesse Rissman and colleagues at UCLA, exactely where the survey was conducted provides solid empirical grounding for this line of inquiry. Their research demonstrates that immersive virtual-reality environments can enhance memory processing by creating richer contextual cues and promoting deeper integration of learned information. In particular, studies from the Rissman Memory Lab show that VR-based simulations not only increase ecological validity but also support more robust encoding and retrieval processes, as evidenced by neural activity patterns associated with context reinstatement and episodic memory formation (Reggente et al., 2018). These neural benefits emerged only when tasks were goal-directed and scaffolded, reinforcing CAMIL's principle that *purposeful immersion* yields meaningful learning. Across the broader literature, Radianti et al. (2020) reviewed 38 studies in higher education and found that VR reliably supports conceptual and spatial understanding, especially in STEM disciplines, though its efficacy is constrained by technical readiness and cognitive demands. The metaverse, characterized by persistent and social 3-D environments, extends these affordances to multiuser contexts. Despite encouraging results, the integration of VR and metaverse technologies raises practical and ethical challenges. Technical barriers such as device cost, motion discomfort, and connectivity issues can limit participation, potentially exacerbating educational inequities. Pedagogically, instructors should design evidence-driven pilot programs that evaluate VR's contribution relative to established baselines. As Radianti et al. (2020) emphasize, the most effective implementations begin with clearly defined learning outcomes rather than hardware availability. Immersive modules should target domains where embodiment adds measurable cognitive or affective value procedural mastery, spatial reasoning, empathy training while always providing equivalent non-VR pathways for learners constrained by health, equipment, or personal preference. Successful immersive learning follows a three-phase cycle: *pre-briefing*, *guided experience*, and *debriefing*. Pre-briefing orients students to objectives and minimizes novelty-related distraction; guided prompts sustain attention during immersion; and debriefing consolidates understanding through reflection (Makransky & Petersen, 2021). When these elements align, presence becomes a cognitive asset rather than a source of overload. Conversely, neglecting structure risks turning VR into passive entertainment, a phenomenon sometimes termed “presence without pedagogy.”

Taken together, the emerging scholarship suggests that VR and metaverse applications represent not a replacement but an *extension* of experiential pedagogy. When instructional design manages cognitive load, promotes authentic social presence, and embeds structured reflection, immersive learning can equal traditional modalities. However, without such alignment, the same sensory richness that makes VR compelling can undermine focus and retention.

Conclusion

This survey, conducted within UCLA’s Department of European Languages and Transcultural Studies, offers a carefully delineated view of how instructors perceive online teaching, how they navigate its practical demands, and where they locate their most pressing professional needs. Although the study is cross-sectional and limited to a single academic unit, its value lies in its diagnostic reach: it brings to light the points at which pedagogical design, digital environments, and institutional support intersect, and it highlights the conditions under which evidence-based practices may take hold and endure. Rather than advancing causal claims, the analysis invites a measured interpretation of the data, one oriented toward thoughtful planning, faculty development, and future programmatic experimentation.

The findings will be examined alongside the results of the companion survey administered to UCLA students, allowing for a comparative understanding of expectations, constraints, and learning experiences across stakeholder groups. Moreover, these qualitative data will be put in relation to the conceptual frameworks presented in the opening chapter and to the neuro-educational perspectives developed in the subsequent chapter on cognitive and neural bases of online learning. By integrating these different layers of faculty perspectives, student experiences, and theoretical foundations, the final chapter will be able to articulate a set of guidelines for online university teaching that is pedagogically coherent, methodologically grounded, and attentive to the cognitive demands of contemporary digital learning environments.

CHAPTER V

Guidelines for University Distance Education: Integrating Cognitive Science, Pedagogical Research, and Institutional Practice

The Origin and Function of the Guidelines

Every system of pedagogical norms, when deprived of its epistemological foundations, risks degenerating into a mere manual of technicalities. The guidelines that constitute this final chapter, by contrast, are conceived not as a compilation of best practices but as the synthetic expression of a complex process of inquiry, one that traverses the domains of neurocognitive science, educational theory, and empirical observation. They are, in this sense, the final sedimentation of a research path whose premises were already delineated in the first chapters of this dissertation: the theoretical framing of digital pedagogy, the neurophysiological reconstruction of learning in mediated contexts, and the double empirical investigation carried out at UCLA with two distinct populations professors and students engaged daily in the experience of online higher education. In the chapter dedicated to the *neurocognitive foundations of distance learning*, we established that the transition from the physical to the digital classroom represents not a mere logistical or technological displacement, but a true reconfiguration of the brain's operational parameters. Attention, working memory, and long-term consolidation, once governed by shared spatial and temporal coordinates, must now be sustained through symbolic and procedural scaffolds; the learner's executive functions are required to compensate for the loss of implicit social and spatial cues. From this awareness emerged the conviction that every pedagogical reflection on online teaching must begin with a reconsideration of the brain's ecological adaptation to mediated environments (Mayer, 2021; Sweller, 2019; Dikker et al., 2017; Posner & Rothbart, 2007).

If neurocognitive theory offered the physiological horizon, the empirical analysis of UCLA faculty perceptions supplied the pragmatic dimension. As described in the study of chapter 4, the instructors' testimonies reveal both the richness and the fragility of digital education. Professors perceive online teaching not as an impoverished surrogate but as a field requiring deliberate orchestration , a domain where clarity, rhythm, and coherence become the equivalents of spatial proximity and embodied presence. Their reflections on the need for consistent course architecture, transparent assessment rubrics, and institutional support form an indispensable complement to the neuroscientific premises established earlier.

The UCLA Student Survey, analyzed, conversely, provided the phenomenological counterpart: it articulated the expectations, frustrations, and adaptive strategies of learners exposed to an environment where cognitive self-regulation and social visibility are constantly negotiated. Students report that they learn best when the online space offers visual stability, predictable rhythm, and opportunities for synchronous acknowledgment, findings that resonate profoundly with the principles of attention coupling and social synchronization outlined by Dikker et al. (2017) and Immordino-Yang and Damasio (2007).

The guidelines that follow, therefore, do not seek to prescribe but to translate the entire corpus of these findings into a coherent conceptual architecture. They are founded on suitable E-learning pedagogical principles**,** on the findings of contemporary neuroscience and neurodidactics**,** and on the preferences and practical insights expressed by professors and students through empirical surveys**.** Their aim is to translate theoretical and empirical knowledge into concrete criteria of instructional design; criteria capable of shaping an updated, sustainable, and cognitively aligned model of university e-learning that harmonizes educational theory, scientific evidence, and the lived experience of academic teaching and learning**.**

The Logic of Integration: From Neuroscience to Pedagogy

One of the principal ambitions of this work is to overcome the artificial separation between cognitive science and didactic practice. Historically, educational theory has oscillated between normative approaches prescribing what the teacher ought to do and interpretative ones, describing how the learner behaves. The digital transition, however, tends to a more radical synthesis; it obliges us to think of the didactic act as a neurocognitive event, situated at the intersection of mind, medium, and institution. From this perspective, the Cognitive Theory of Multimedia Learning (Mayer, 2009, 2021) and the Cognitive Load Theory (Sweller, 1988, 2019) jointly provide the foundation for this synthesis. Both assert that learning depends on the efficient management of limited working-memory capacity, but they diverge in focus: Mayer is concerned with the dual-channel architecture of information processing the coordination of visual and auditory inputs, while Sweller emphasizes the load imposed by task complexity and instructional design. Both conceptions converge in the assumption that design mediates cognition: the form of presentation can either amplify or suppress the learner's ability to construct meaning. What emerges from the UCLA surveys data of chapter 3 and 4, especially from the *faculty perception survey*, is a spontaneous convergence with this cognitive model. Instructors repeatedly emphasize the importance of visual coherence, modular segmentation, and rhythmic alternation between exposition and interaction. Without necessarily invoking in the questions proposed by the concept of cognitive load, their descriptions correspond almost perfectly to the tripartite taxonomy proposed by Sweller ; intrinsic, extraneous, and germane load and to Mayer's principle of signaling and coherence as discussed in paragraph 14 of the chapter 2 . This suggests that the empirical wisdom of experienced instructors anticipates, at the level of intuition, what experimental psychology has demonstrated through controlled study: that pedagogy and cognition are not parallel domains, but one and the same process seen from two perspectives.Similarly, the students' answers, as reconstructed in the *UCLA Student Survey*, confirm the theoretical postulate that cognitive engagement is inseparable from emotional and social activation. Their responses reveal a strong preference for environments where they feel "seen," "accompanied," and "recognized," conditions that, from a neurobiological point of view, correspond to the activation of reward circuits and social-affiliation networks (Schultz, 2015; Immordino-Yang & Damasio, 2007). Thus, the pedagogical imperative to design courses that include affective and social dimensions is not sentimental but neuroscientific: it derives from the organism's inherent need for affective coherence between effort and recognition.

It follows that these guidelines must be read as the didactic translation of cognitive evidence. Every recommendation that will be articulated in the following sections concerning structure, rhythm, interactivity, or evaluation is based on the same axiom that the brain learns better when it does not have to fight against the medium.

Comparative Framework and Institutional Sources

To ensure that the guidelines possess not only theoretical legitimacy but institutional relevance, the research also engaged in a systematic review of existing frameworks from leading universities: Harvard, MIT, Stanford, Yale, and, within the Italian context, the CRUI (Conference of Italian University Rectors) and the University of Padua. Although these documents differ in scope ranging from the Harvard Derek Bok Center's focus on reflective teaching to MIT's emphasis on open-access technological integration, they share several core premises. All of them recognize that online education is not a diminished form of teaching but a distinct epistemic environment, one that requires explicit design of presence, temporality, and interactivity. From these institutional sources emerge five convergent principles:

- Transparency of objectives and pathways: learning goals must be visible and traceable.
- Predictability of structure: every module should follow a consistent rhythm.
- Active engagement: the student must not merely consume content but manipulate it.
- Feedback integration: evaluation must function as dialogue, not as judgment.

- Instructor visibility: teaching presence must be cognitively and socially perceivable even in asynchronous modalities.

Each of these principles finds theoretical validation in the literature (Mayer, 2021; Sweller, 2019; Pekrun, 2006) and empirical confirmation in the UCLA surveys. When students declare that they feel “disoriented” by courses without clear modules, or when instructors request institutional templates, they are, in effect, describing the same need for cognitive mapping that the Harvard and MIT documents formalize as “transparent architecture.”The alignment between empirical perception, cognitive theory, and institutional practice thus provides the triple legitimacy of these guidelines.

Epistemological Principles

The epistemological horizon within which these guidelines are situated can be summarized as follows: teaching is not only a social practice or a transfer of knowledge, but also a designed system for shaping and enhancing human cognition. The effectiveness of Distance Learning (DL), according to Rivoltella (2021), is not achieved by merely transferring content into a digital format, but rather as an act of deliberate methodological planning, which he terms Intentional Design. This framework requires the educator to focus primarily on the overall course architecture, ensuring the learning environment is structured with systemic precision. A critical component of this design process involves integrating principles of digital ergonomics and usability: materials and interfaces must be specifically conceived to optimize student interaction, thereby streamlining access to information and minimizing any form of cognitive load extraneous to the learning process itself. This does not imply that education is reducible to technique, but that every pedagogical gesture is, in itself, a form of cognitive mediation. The instructor, whether in presence or online, operates as an external prosthesis of the learner’s executive functions: guiding attention, organizing information, and maintaining motivation (Clark & Chalmers, 1998; Damasio, 2021). The digital environment intensifies this mediating role. When the embodied cues of co-presence are absent, eye contact, spatial orientation, and subtle affective feedback, the design must compensate by amplifying symbolic and procedural cues. Thus, the concept of teaching presence (Garrison et al. , 2000), rediscovered in much of the literature, can be reinterpreted through the lens of neurocognitive substitution: the interface, the voice, and the visual structure of slides become surrogates of gesture and proximity. Within this framework, Mayer’s and Sweller’s theories acquire normative force. The principle of modality, for example, which recommends presenting information through complementary auditory and visual channels, responds directly to the brain’s dual-processing architecture. Similarly, the principle of segmenting corresponds to the temporal limits of working memory, while redundancy warnings align with evidence on split attention. To ignore these constraints is not merely inefficient; it is cognitively unethical, as it imposes unnecessary load on the learner. The epistemological implication is profound: didactic quality coincides with cognitive sustainability. To teach in a way that respects how the brain learns is not an act of methodological fashion but of epistemic responsibility. It is, as the first chapter of this dissertation argued, the very condition of an ethically grounded pedagogy. Taking into account these premises, online teaching guidelines cannot be reduced to operational prescriptions. They represent instead a synthesis of systems: the neurocognitive, the pedagogical, and the institutional. Their legitimacy derives from the intersection of empirical observation (the UCLA surveys), theoretical coherence (the cognitive models), and normative convergence (the international frameworks of other prestigious universities). In the following part, the argument will move from the epistemological to the neuro-functional, exploring in greater depth the specific mechanisms attentional, mnemonic, motivational that should orient the architecture of online courses. The aim is not to dictate techniques but to delineate the cognitive logic that must inform every pedagogical decision. As Mayer (2021) argues, effective instructional design is not about embellishing information, but about minimizing extraneous cognitive load to facilitate understanding.

Part I – Multimodality, Presence Technologies, and Advanced Platforms

Presence, Embodiment, and the Neurodidactic Ecology of Digital Learning

The contemporary university stands at the convergence of three technological currents: the structural discipline of learning-management systems (LMS), the sensory immersion of virtual and mixed-reality environments (VR/MR), and the adaptive intelligence of artificial systems that learn from the learner. When viewed together, these currents form not a collage of tools but a single pedagogical ecosystem neuro-didactic ecology of presence. Within this ecology, presence no longer denotes physical co-location but the continuity of attention and intention between teacher and learner, the perception that one's cognitive effort is seen, guided, and valued. Such presence can manifest through the intonation of a human voice during a synchronous seminar, through an adaptive algorithm that offers timely scaffolds, or through the gaze of an avatar whose posture mirrors attentiveness. In every case, the underlying mechanism remains the same: the synchronization of expectation and response that stabilizes engagement and translates perception into understanding. Recent empirical studies confirm that the sense of presence functions as the psychological substrate of meaningful learning. Martin, Wu, Wan, and Xie (2022) have demonstrated that the three presences articulated in the Community of Inquiry framework teaching, social, and cognitive are significantly correlated with perceived learning and satisfaction in both online and blended environments. These dimensions interact dynamically: teaching presence designs the structure and rhythm of the encounter; social presence humanizes it; cognitive presence converts interaction into reflection. When the ecology of technology sustains this triad-when LMS, VR, and AI cooperate rather than compete the learner's attentional system finds coherence, and the abstract environment acquires emotional reality. From a neurocognitive standpoint, this coherence arises because the brain's mechanisms for learning are exquisitely sensitive to rhythm and sensory integration. As shown in chapter II, attention, working memory, and long-term retention depend on temporal predictability and multimodal harmony. Virtual and mixed-reality environments extend this principle by transforming learning from symbolic abstraction into spatial and motor experience. When the perceptual field includes movement, spatial depth, and social co-presence, the circuits governing attention and memory are more fully engaged; when such coherence is linked to meaningful goals, affective resonance follows, turning knowledge into experience (Bailenson, 2018; Dikker et al., 2017; Mayer, 2021). The virtual classroom, therefore, should not be conceived merely as an imitation of physical space but as a re-articulation of cognitive affordances: a site where gesture, gaze, and auditory framing converge to sustain attentional anchoring and to render thought visible. This is the pedagogical horizon that institutions such as Harvard, MIT, and Stanford are beginning to explore in their large-scale digital programs. Their platforms, once designed as repositories of content, are being redesigned as environments of cognitive empathy: systems structured to mirror the learner's temporal and emotional rhythms. In parallel, UCLA's Bruin Learn built on Canvas and enriched by data-driven analytics represents a similar step toward adaptive design. Tan et al., (2025) notes that AI-enabled adaptive learning platforms can monitor pace, identify patterns of confusion, and adjust the level of challenge in real time, thereby reducing extraneous cognitive load and sustaining meaningful engagement. These adaptive systems convert the LMS from a static archive into a responsive interlocutor, one capable of detecting when attention wanes and proposing a change of tempo or modality before cognitive fatigue solidifies into disengagement. Yet, for all their promise, immersive and adaptive technologies must remain subservient to a single criterion: fidelity to the brain's economy of attention. Every affordance visual, interactive, or adaptive-must justify its existence by demonstrating that it diminishes cognitive friction and enhances meaning-making. As Mayer (2009, 2021) and Sweller (2019) have shown, comprehension flourishes when stimuli are coherent and germane, and declines when vividness overwhelms structure. The temptation to overload perception with redundant narration or excessive motion is as real in virtual worlds as in slideshows; the principle of cognitive load applies with equal rigor. Consequently, immersive pedagogy must observe the same laws of signaling, contiguity, and segmentation that govern effective multimedia learning (Mayer & Moreno, 2003). In a well-designed environment, a student walks not for the sake of motion but to traverse a conceptual relation; the instructor's gesture, physical or virtual, does not decorate discourse but directs attention toward correspondence between structure and function. At this intersection of embodiment and abstraction, virtual reality becomes an instrument of embodied cognition. Research at Stanford's Virtual Human Interaction Lab (Bailenson, 2018) demonstrates that immersive experiences can replicate the depth of social presence that fosters empathy, while enabling forms of spatial reasoning unattainable in the conventional classroom. When learners "walk through" cardiac atria or navigate geological strata, the hippocampal formation, which encodes both spatial and episodic structures, becomes the substrate of conceptual retention (Bellmund et al. , 2018). From a neurophysiological perspective, such sensory-motor coupling activates mirror-neuron systems, motor cortices, and associative networks that stabilize the link between perception and meaning (Rizzolatti & Sinigaglia, 2016; Immordino-Yang & Damasio, 2007). These mechanisms explain why, even in two-dimensional environments, students report higher engagement when professors use gesture, drawing, or visual annotation. Immersive technologies amplify precisely these mechanisms, extending the cognitive map into three dimensions. However, the amplification of engagement also magnifies risk. Frederiksen et al., (2020) have shown that prolonged exposure to visually rich environments can elevate cognitive fatigue and interfere with memory consolidation if reflection and downtime are not built into the learning schedule. The ethical imperative, therefore, remains constant: presence must alternate with repose, and immersion must be punctuated by intervals of reflection. The UCLA surveys echo this physiological truth: students experiencing long synchronous sessions reported exhaustion rather than flow. To transform immersion from spectacle into understanding, designers must plan short immersive sequences followed by asynchronous debrief moments in which experience crystallizes into knowledge. When properly balanced, such environments can become laboratories of deep understanding rather than theaters of distraction. The metaverse extends this logic to a collective horizon, offering persistent learning spaces where communities of inquiry evolve over time, where artifacts of one cohort become scaffolds for the next, and where embodied collaboration generates shared meaning. Yet this promise demands epistemic discipline. Without clear pedagogical aims, virtual campuses risk devolving into performances of novelty devoid of depth. Universities like Stanford and MIT have therefore adopted cautious experimentation, grounding virtual laboratories in clear curricular objectives and ensuring that every navigable world corresponds to a conceptual world. Immersion, in this disciplined sense, is not a spectacle of information but a dramatization of understanding. In light of these developments, the integration of LMS, VR, and AI should not be read as technological convergence but as the manifestation of a single pedagogical ideal: to align design with cognition. The LMS provides structure, continuity, and transparency; VR supplies sensory immersion and embodied exploration; AI contributes adaptivity and feedback. Together, they reconstruct the ancient art of teaching the staging of knowledge so that it may be felt and manipulated before it is abstractly grasped. The decisive factor will not be the sophistication of the instrument but the fidelity with which it respects the learner's cognitive and emotional economy. When technology, empathy, and neuroscience converge under the governance of purpose, the classroom, whether physical, virtual, or hybrid, can again become what it was always meant to be: a space where thought takes form.

Learning Management Systems as Cognitive Infrastructures

In the architecture of online learning, the Learning Management System (LMS) is both invisible and indispensable. It constitutes the skeleton beneath the virtual body of teaching, a silent architecture that organizes perception and expectation. When designed coherently, it becomes what Sweller et al. (2011) would describe as a cognitive prosthesis-an externalization of working memory that sustains the learner's fragile equilibrium between attention and comprehension. When incoherent, it collapses into noise: a proliferation of stimuli that compete for executive control and transform study into navigation. The LMS, in this sense, does not simply deliver content; it mediates cognition itself, translating the principles of psychology into the grammar of interface. The metaphor of the LMS as prosthesis or cognitive infrastructure captures its neuro-didactic role. A well-structured platform externalizes executive functions, organizing time, allocating attention, and encoding procedural expectations that the learner gradually internalizes. As Mayer (2021) and Sweller (2019) have shown, such externalization reduces extraneous cognitive load, allowing germane load-the portion of effort devoted to understanding-to expand. The LMS thus operates as a shared working memory between teacher and student, distributing the burden of coordination so that mental energy may be spent on meaning rather than mechanics. In this sense, design is not neutral but pedagogical: every icon, tab, and sequence expresses an implicit theory of learning. Among contemporary platforms, three major systems-Moodle, Canvas, and Sakai, illustrate this principle through contrast. Moodle, born as an open-source experiment in pedagogical freedom, embodies the ethos of maximal flexibility. It permits an instructor to build from the ground up a bespoke architecture of plugins, branching activities, and personalized hierarchies. Yet, as both UCLA faculty surveys and cognitive-load theory confirm, abundance without hierarchy generates friction. Instructors often report that Moodle's openness produces inconsistency across courses, multiplying navigational uncertainty and distracting students from content (Sweller et al. , 2011; Mayer, 2021). From a neurocognitive viewpoint, such variability imposes excessive demands on the prefrontal systems responsible for inhibition and task switching, thereby diminishing the cognitive energy available for schema construction (Sweller, 2019).

Canvas, by contrast, the basis of UCLA's Bruin Learn ecosystem, represents the opposite pole: constraint as clarity. Its modular organization and stable navigation-anchored by a persistent left-hand menu-mirror the learner's need for predictability. This design enacts Mayer's (2009) segmenting principle, dividing content into cognitively manageable units and making progress visually traceable. It reduces the uncertainty of orientation, transforming the course from a labyrinth into a narrative sequence. The same modularity facilitates integration: assessment, feedback,and communication coexist within a single interface, closing the loop between performance and reflection. Such immediacy corresponds to what Pekrun (2006) terms the motivational function of achievement emotions: engagement is sustained when feedback is timely, specific, and emotionally legible. Sakai, still used in some institutions, occupies a middle ground. Its distributed toolset promotes collaboration and peer review but lacks the intuitive continuity of Canvas's linear model. The cognitive result is measurable: higher switching costs, more divided attention, and greater risk of fatigue. The comparison among these systems is not merely technical but neuropsychological. It reveals how interface design modulates the brain's allocation of resources, how architecture becomes pedagogy.

The evidence gathered at UCLA by students and professor surveys corroborates this interpretation; the transition from the Moodle-based Common Collaboration and Learning Environment (CCLE) to Bruin Learn in 2021 was motivated by precisely these cognitive and ergonomic concerns (Daily Bruin, 2021; UCLA Digital Technology Services, n. d.). Canvas was selected for its interoperability with academic tools such as Gradescope and Slack, its consistent structure across the UC system, and its improved mobile accessibility and notification logic-all elements that align usability with cognitive efficiency. The surveys presented in Chapters II and III confirm that courses employing stable navigation, fixed icons, and centralized access to materials recorded fewer help requests and higher satisfaction. Students explicitly associated clear structure with reduced anxiety and enhanced comprehension, while instructors reported that predictable interfaces freed class time for dialogue rather than troubleshooting. The LMS, in this light, functions as a cognitive infrastructure of trust. From a theoretical standpoint, such trust is the institutional expression of what Mayer (2021) calls coherence: the alignment of content, format, and purpose. When coherence governs design, the learner's executive control relaxes, and attention can be directed toward germane processing. A predictable structure, consistent color palette, and limited typographic variation are not aesthetic choices but neurocognitive interventions. They enact what Immordino-Yang and Damasio (2007) describe as the emotional preconditions of sustained motivation-clarity and safety. Conversely, when design is opaque, confusion becomes emotional noise, eroding both confidence and concentration. The affective and cognitive dimensions of interface are inseparable: clarity is a form of care. Institutions that standardize these design virtues through templates perform, as it were, an act of cognitive justice. They ensure that intellectual energy is spent on ideas rather than logistics, that the conditions of learning are equitable regardless of an instructor's digital literacy. The UCLA findings parallel the recommendations issued by Harvard, MIT, and Yale, all of which define the LMS not as a repository but as a narrative medium. The course site must tell, through its architecture, the story of the learning journey: where it begins, how it unfolds, where it leads. In such a narrative environment, the student perceives progress as meaningful continuity rather than a series of disconnected tasks. From this perspective, technology must always serve pedagogy, not the reverse (Clark & Mayer, 2016). The LMS should be designed neither as a monument to institutional branding nor as a collection of tools but as an extension of cognition itself-an external brain whose task is to relieve the learner of superfluous management and to sustain the delicate balance between attention, memory, and emotion. The lesson of Bruin Learn, confirmed across both UCLA surveys, is that simplicity, coherence, and stability are not constraints but affordances. They make learning visible and teaching sustainable.

Thus, the LMS emerges as a neuropsychological artifact, mirroring and amplifying the cognitive architecture of its users. Its ethical function is double: to distribute cognitive effort fairly and to translate pedagogical intention into perceptual order. When this translation succeeds, technology dissolves into transparency, and the digital classroom becomes once again what every classroom aspires to be-a space where form and meaning coincide.

Artificial Intelligence in online courses of higher education

The incorporation of artificial intelligence into online university teaching has reignited a debate reminiscent of the intellectual upheaval once provoked by the printing press: does automation free thought or weaken it? In the context of distance education, this question acquires new depth. When instruction unfolds through screens, networks, and asynchronous exchanges, the boundaries of cognition itself shift. The effectiveness of learning no longer depends solely on the instructor's presence but on how digital environments regulate attention, distribute feedback, and sustain motivation. Within this ecology, AI emerges as both an ally and a risk: an ally when it supports the learner's cognitive economy, a risk when it fragments focus or obscures responsibility. From a neuro-didactic standpoint, the human brain learns most effectively not by absorbing vast amounts of information, but by regulating cognitive load, spacing retrieval, and linking emotional reward with intellectual effort. These conditions, already fragile in face-to-face classrooms, become even more precarious online, where the immediacy of interaction is diluted. Artificial intelligence, if properly designed, can restore some of this lost synchrony. Adaptive algorithms can monitor engagement, vary task difficulty, and structure feedback intervals in ways that emulate the natural rhythms of the hippocampus, the brain's center for memory consolidation (Born & Wilhelm, 2012). This alignment between machine pacing and neurobiological cycles transforms AI into what might be called a neuro-didactic collaborator: a digital counterpart to the processes through which attention becomes understanding. The most direct form of such collaboration appears in adaptive learning systems that adjust to each learner's tempo. Research on distributed practice demonstrates that retention increases when reviews occur at the edge of forgetting (Cepeda et al. , 2006). In asynchronous online courses, where students' study schedules are heterogeneous, an AI engine capable of identifying this moment can individualize revision prompts, ensuring that cognitive effort is neither wasted on redundancy nor lost to premature challenge. Thus, artificial intelligence recreates one of the essential pedagogical functions that distance learning tends to erode: rhythm. A parallel transformation concerns feedback. The UCLA faculty surveys consistently report a tension that defines online instruction: professors acknowledge that timely and specific feedback is decisive for learning but find it increasingly unmanageable at scale. When students submit dozens of assignments through the LMS, the temporal gap between submission and response widens, and motivation dissipates. AI-assisted feedback generation, if transparent, criterion-based, and subject to human interpretation, can narrow this gap. As Mayer (2021) and Pekrun (2006) have shown, feedback is not merely cognitive correction; it is an affective signal, a reinforcement of self-efficacy and belonging. Automated comments that highlight conceptual progress or identify specific errors can maintain continuity, provided that the instructor remains the visible and ethical author of judgment. In this way, AI functions as an extension of pedagogical presence, allowing instructors in online courses to project attention even across temporal and spatial divides. AI's contribution extends further when integrated into formative dialogue. Online teaching suffers from the attenuation of spontaneous discussion, the subtle cues of eye contact, gesture, and tone that sustain engagement in physical classrooms. Natural language processing systems can now map arguments, summarize threads, or visualize conceptual links generated in digital forums. These tools render participation visible, allowing instructors to identify silent students or recurring misconceptions. In the UCLA surveys, the desire for visibility-for knowing that one's contributions are noticed-emerged as a dominant theme. AI analytics that track discourse patterns can thus restore the reciprocity of presence without resorting to surveillance. As Dikker et al. (2017) observed, attention synchrony is a social phenomenon: brains learn together when they feel attended to. In online courses, where co-presence is abstract, AI can mediate this attentional justice, ensuring that distributed learners still experience shared focus.

These theoretical premises are now substantiated by concrete institutional practice. Across global higher education, AI tools are being adopted precisely to address the cognitive and logistical challenges of online learning. Gradescope, a system for AI-assisted grading, has been widely implemented to manage the volume of digital submissions. Empirical studies demonstrate that it reduces grading time and increases inter-rater reliability, especially in large courses (Singh et al., 2017; Zhao, 025). In fully online contexts, where asynchronous assessment is the norm, such consistency becomes indispensable to fairness and clarity. Similarly, Perusall, a social-annotation platform enhanced by AI analytics, has been shown to raise pre-class engagement and deepen conceptual understanding in virtual and hybrid environments (Cui & Wang 2024). Its ability to visualize participation and automate formative feedback exemplifies how AI can transform the passive consumption of digital texts into active, communal interpretation. Even when developed for traditional classrooms, such platforms translate seamlessly into online teaching, where sustaining dialogue and intellectual tone is notoriously difficult. By filtering noise, highlighting substantive contributions, and offering real-time cues, AI reduces the communicative entropy that often characterizes digital forums, allowing the instructor to intervene with meaning rather than maintenance. AI's influence also extends to the domain of academic integrity, one of the most contested aspects of online assessment. Tools like Turnitin, long used to detect plagiarism, now include AI-writing indicators that flag probabilistic originality concerns. While these systems can help instructors maintain standards, scholarly analyses warn against overreliance, citing high false-positive rates and algorithmic bias (Cotton et al. , 2023; Elkhtat et al., 2024). Within the online classroom, integrity must therefore be taught, not merely monitored. AI should educate before it polices, showing students the cognitive difference between paraphrase and synthesis, the ethical meaning of citation, and the intellectual dignity of authorship. The question becomes even more complex with AI-based proctoring systems such as Respondus or Honorlock, which use computer vision and behavioral analytics to verify student identity and detect irregularities during remote exams. Their adoption has expanded dramatically with the normalization of online testing (Nigam et al., 2021). Yet they expose deep ethical fractures. By recording faces, gazes, and environments, such systems challenge privacy norms and sometimes violate the European GDPR framework. More importantly, studies and student testimonies alike indicate that excessive monitoring increases anxiety, narrows attentional scope, and can reduce performance even among honest examinees (Cain et al.,2011). The UCLA student surveys echo this pattern, describing remote proctoring as "dehumanizing" and "stressful. " The principle that should guide universities, therefore, is discernment over suspicion. AI can verify procedural regularity, but only the instructor can interpret meaning. Technology should assist human judgment, not replace it. Collectively, these instruments, adaptive tutors, automated graders, discussion moderators, analytic dashboards, and integrity systems compose what might be described as the neuro-didactic infrastructure of online higher education. Each tool externalizes a cognitive function of the instructor: attention tracking, memory scaffolding, feedback timing, or evaluative consistency. When orchestrated coherently, they form a digital ecology capable of restoring some of the immediacy lost in online teaching. Yet, as Immordino-Yang and Damasio (2007) remind us, learning is not only informational but affective: it thrives where emotion and reason cooperate. The task of AI, therefore, is not to emulate empathy but to amplify it to preserve warmth, responsiveness, and trust across the distance of the screen. This vision introduces the domain of ethics, where the problem of automation becomes inseparable from that of transparency. In the online environment, every act of mediation must be disclosed: students should know when a recommendation or grade is algorithmically generated, by what rationale, and for what purpose (European Commission, 2022). Such transparency sustains academic trust, the moral currency of online education (Karran et al. ,2024). Instructors, in turn, must retain interpretive sovereignty, using algorithmic suggestions as inputs rather than verdicts; the integrity of digital pedagogy depends on this partnership between human judgment and machine precision (Mahajan, 2025). Ethical responsibility also extends to data privacy and fairness. Online courses generate extensive interaction data clickstreams, keystroke timings, video log data that feed AI systems. Without rigorous governance, these datasets risk becoming instruments of surveillance or reinforcing bias (Barthwal et al. , 2025). The "Ethical Guidelines on the use of AI and data in teaching and learning" issued by the European Commission (2022) emphasise human agency, oversight, fairness, transparency, privacy and data governance as core requirements. In this light, attentional justice, the fair distribution of cognitive visibility among learners, should replace the logic of control.

The broader goal, then, is to establish what might be called an ethics of cognitive efficiency: ensuring that every digital intervention reduces, rather than increases, cognitive friction. The true value of AI in online teaching lies in how well it aligns with the learner's limited attentional resources (Mayer, 2021). When the design of a LMS, an adaptive engine, or a feedback system is guided by clarity, coherence, and empathy, it supports the brain's natural economy of effort. Conversely, when complexity or opacity increases extraneous load, technology undermines the very cognition it was meant to enhance (Sweller, 2019). From a systemic perspective, these developments point toward a future of hybrid intelligence. AI ethics research in higher education argues that human-driven AI frameworks must govern institutional adoption of algorithmic pedagogy (Mahajan, 2025). Within this model, online teaching ceases to be a derivative mode of education and becomes a laboratory for cognitive ethics. Here, artificial intelligence is not a substitute for presence but a medium for its reconstruction-a way of making attention, feedback and fairness perceptible even across the digital divide (Karran et al. , 2024). The neuro-didactic ethics of AI in online university teaching demand a delicate equilibrium. Automation must remain transparent, data use must respect privacy, and algorithmic decisions must always be interpreted through human empathy. When these conditions are met, AI can transform distance from a pedagogical handicap into a space of renewed cognitive intimacy. Properly aligned with sound instructional design, transparency and ethical oversight, it allows the online classroom to become what education has always aspired to be: a place where intelligence-human and artificial-collaborate in the act of understanding.

Part II – Didactic Implications of Neurocognitive Foundations

A Different Cognitive Physiology for Mediated Learning

If we accept, as argued in chapter 2 on the neurocognitive bases of distance learning, that cognition is not indifferent to the medium through which instruction unfolds, then the move from co-present to mediated teaching must be described as a change in cognitive ecology rather than a simple displacement of content delivery. The brain of students who take courses online organizes attention, constructs meaning, and consolidates memory within a symbolic and interactive habitat whose affordances diverge from those of the physical classroom: spatial anchors are weaker, social cues are thinner, and self-regulatory demands become continuously explicit. In the physical classroom, the stability of place, the predictability of ritual, and the richness of embodied signals saturate encoding with multisensory and socio-emotional tags; in the digital setting, by contrast, the learner often negotiates a fluctuating interface, an unstable audio-visual pipeline, and a social presence that must be deliberately engineered to be felt as real. Under these conditions, the classical architecture of learning, selection, organization, and integration of information requires supports that substitute for what the body and the room ordinarily provide (Mayer, 2009, 2021). The Cognitive Theory of Multimedia Learning assumes dual-channel processing and limited working memory: it follows that coherence, signaling, contiguity, and segmentation are not ornamental rules but the minimum conditions for cognitive economy. The coherence principle holds that *extraneous information even if interesting consumes working memory and interferes with the construction of mental models*. Because learners' attention and cognitive load are limited, any unnecessary stimuli (text, images, sounds) reduce cognitive efficiency. In practice , instructors must present only content that directly supports the instructional goal. Use uncluttered slides with essential keywords and relevant visuals. Remove background music, decorative images, or side anecdotes not directly functional to comprehension. They should avoid adding "fun" but unrelated videos or graphics to keep attention this backfires cognitively. Another thing to avoid is using dense text slides that repeat what the lecturer says verbatim. Signaling (also called cueing) that refers to *directing learners' attention to the relevant elements of information structure* is another relevant principle to be applied because working memory is limited, learners benefit from cues that reveal hierarchy, relationships, or conceptual boundaries. In practice, professors should use visual cues like arrows, color contrasts, or bolding to emphasize key processes or transitions. They should verbally announce the structure ("Now we move from causes to effects").   It is also very effective the use of consistent iconography or highlighting in slides to mark definitions, examples, and conclusions. At the same time, the instructor should avoid leaving learners to infer structure from raw text or speech alone. Changing cueing styles arbitrarily (e.g.,sometimes underlining, sometimes italicizing, sometimes coloring differently). As far as the Contiguity Principle is concerned is crucial to lign words and images in space and time. *Learning is stronger when related verbal and visual elements are presented close together*, spatially and temporally. Otherwise, learners must split attention between separated sources, wasting cognitive resources on searching rather than integrating. Professors should place text labels next to the corresponding parts of a diagram (not in a separate legend). Another important step should be to synchronize narration with the appearance of visuals. Also integrate quizzes or reflection prompts immediately after the relevant concept, not at the end of the lesson. On the contrary they should avoid to show a diagram first and explaining it later ("we'll discuss this in a moment"). Another bad practice to avoid is putting key explanations in downloadable PDFs separate from the video or presentation. For example, during an anatomy lecture online, when showing the human heart, the professor should label the atria and ventricles directly on the image *while* describing blood flow. He must avoid referring to "the part you saw on the previous slide" the learner's working memory cannot hold both. The Cognitive Load Theory further clarifies that what impedes learning is seldom the intrinsic complexity of knowledge, but rather the extraneous friction introduced by a design that multiplies wayfinding, redundancies, and split streams (Sweller, 1988; Sweller, 2019). The UCLA faculty perceptions reinterpreted in the chapter devoted to professors' views converge almost point for point with this model: instructors repeatedly recount that students flourish when visual layouts are stable across weeks, when expectations are explicit and objectives are visible, and when interactive moments interrupt the passivity of long expository sequences. The students' accounts (as analyzed in the chapter on UCLA learners' experiences) complete this picture from the opposite perspective: they emphasize that being oriented within a predictable structure and being recognized within a community are not secondary comforts but the very scaffolds of attention and memory (Dikker et al., 2017; Immordino-Yang & Damasio, 2007). It is in this nexus between design constraints and neuro-functional conditions that the present guidelines will locate their argument: to teach online is to recompose, through symbolic and procedural strategies, the spatial, temporal, and social scaffolds that the bricks-and-mortar classroom ordinarily supplies for free (Mayer, 2021; Sweller, 2019).

How to deal with Attention, Executive Control, and the Gatekeeping of Working Memory

Attention remains the gate through which all learning must pass. The classical tripartition alerting, orienting, and executive control helps articulate why mediated learning strains vigilance differently than co-present instruction (Posner & Rothbard, 2007). As we discussed about attentional systems in the neurocognitive chapter , in online teaching, the alerting system is undermined by the continuous presence of alternative stimuli notifications, parallel tabs, ambient apps whose salience competes with the didactic stream, so the instructor must keep all these threads under control or even block them. The orienting system, which in the classroom is stabilized by a central channel (voice + gesture + board), must now coordinated by the instructor who must deal with care among windows and frames, chat overlays, and documents, often with spatial separation that enforces split attention (Mayer & Moreno, 2003). The executive system is taxed because pacing, inhibition, and task-set maintenance cannot be offloaded to the classroom's tacit rituals; they become the learner's constant burden, a fact that the UCLA student narratives repeatedly describe in terms of fatigue and "attention scattering" during long synchronous sessions. Neuroscientific evidence converges with these reports. Media multitasking correlates with increased distractibility and compensatory recruitment of control regions, a profile that does not translate into superior capacity but into greater effort for equivalent focus (Ophir et al., 2009; Moisala et al., 2016; synthesis already discussed in your neurocognitive chapter). The implication is already internal to the design theories I have cited: segmenting long explanations into cognitively digestible units, signaling where to look and when, collocating related elements (text, figure, narration) in space and time to avoid expensive mental integration these are not matters of style but of neural feasibility (Mayer, 2009, 2021; Mayer & Moreno, 2003). In the UCLA faculty study, the preference for predictable module templates appears as a pragmatic translation of this same logic: by stabilizing the environment, instructors reduce the attentional cost of wayfinding and preserve control resources for understanding. Thus the first didactic implication is clear and non-negotiable: attention must be externally scaffolded; to assume that motivation alone will sustain focus online is to misread the ecology of the medium and the physiology of control (Posner & Rothbart, 2007).

Working Memory Limits, Cognitive Load, and the Ethics of Presentation

Instructors of of all levels and disciplines should always remember that working memory is narrow, fragile, and quickly saturated. As we discussed in the Chapter two, the Cognitive Load Theory distinguishes intrinsic load (the complexity inherent to the content), extraneous load (design-induced friction), and germane load (the productive effort of schema construction) (Sweller, 1988; Sweller, 2019). On these basis , Online courses often expand the second category inadvertently: dissonant page structures, redundant media, and labyrinthine navigation seed a background of continuous micro-decisions ("Where is the reading?" "Which link corresponds to the figure referenced in the video?") that siphon capacity away from sense-making. This translates into a few essential design principles that guide the construction of effective online learning environments. **Coherence** requires the instructor to eliminate any decorative or superfluous elements that do not contribute directly to understanding, thereby preserving the learner's cognitive resources for meaningful processing. **Modality** suggests that verbal explanations should accompany, rather than duplicate, visual information: spoken narration paired with graphics is more effective than displaying the same text on screen, as it engages complementary perceptual channels and prevents redundancy. **Contiguity**, both spatial and temporal, refers to the learner's need to perceive related information as belonging together diagrams, captions, and explanations should appear in closephysical proximity and be presented simultaneously, so that the mind can integrate them without having to search or remember across distance or delay.Finally, progressive disclosure is really effective so that complexity should be revealed gradually, in stages that follow the learner's growing comprehension. Instead of exposing all details at once, the instructor unveils information step by step, allowing each layer of meaning to stabilize before introducing the next.This progression mirrors the natural rhythm of cognition, transformin learning from an overload of data into a coherent and cumulative act of understanding.The instructors at UCLA (chapter IV) ,when reflecting on their own courses, implicitly confirm these same principles as they highlight the pedagogical advantage of clear and coherent instructional structures, together with centralized learning spaces where weekly materials are gathered and easily accessed by all students. Because cognitiveload is limited, every redundant or decorative element represents a loss of opportunity: what adds novelty often subtracts clarity. Each tool or feature that is not coherently aligned with the learning goal distracts the learner and consumes part of the mental energy that should be devoted to understanding. In this sense, Mayer's principles function both as prohibitions and as constructive guidelines; they indicate, on one side, what should be avoided because it wastes attention, and, on the other, what should be createdto direct cognitive effort toward meaningful, or *germane*, learning processes (Mayer,2009,2021;Mayer&Moreno,2003).When students in the UCLA survey recall losing the thread because diagrams and commentary lived in different windows, they provide the phenomenology of what the theory names the split-attention effect; when they praise short, well-paced clips followed by immediate practice, they testify to the segmenting principle and to the value of immediate retrieval as a stabilizer of fragile traces (Mayer, 2009; Born & Wilhelm,2012). The didactic imperative that follows is: design must conserve cognitive resources like a scarce currency, reserving expenditure for sense-making, not for wayfinding (Sweller, 2019; Mayer, 2021).

Encoding, Consolidation, and the Spatial Poverty of Screens

Another milestone in neurodidactic as discussed in chapter 2, is the fact that memory doesn't consist of a single act but a choreography; encoding under attentional selection, synaptic consolidation in the hours that follow, and systems consolidation across days and weeks, whereby the hippocampus gradually hands off to distributed cortical networks (Dudai, 2012; Dudai, Karni, & Born, 2015. The classroom's stable spatiality and synchronous sociality assist this choreography by enriching the trace with multisensory and affective cues, which the hippocampus binds into an episodic index. By contrast, the online environment, if left to its default, reduces spatial anchors: there is no room to remember, no desk to inhabit, no ritualized entrance into a place that fixes content to context. As discussed in chapter 3, the method of loci, and the experimental evidence that spatialized strategies improve recall and sculpt champion-like neural signatures, clarify the paradox: online teaching requires a deliberate virtualization of space, not to imitate walls but to supply landmarks (Dresler et al., 2017; Bellmund et al. , 2018; Mayer, 2009). Here the UCLA students' preference for stable dashboards and recurrent "rooms" (discussion, Q&A, weekly problems) aligns with hippocampal constraints: when the environment is navigable and recurrent, the learner can build a cognitive map that binds content to place, which later becomes a cue at retrieval. Conversely, variable layouts, shifting toolsets, and changes in the locus of materials degrade the coherence of encoding and leave consolidation to repair a noisy trace, an operation that even sleep replay cannot fully redeem (Diekelmann & Born, 2010). The practical corollary is specific: architectural consistency is itself a mnemonic device; regularized "locations" within the LMS (always the same left-hand navigation, a fixed visual identity per module, a canonical place for assessments) are not aesthetic habits but the spatial syntax that makes online knowledge retrievable (Mayer, 2009, 2021).

Emotion, Reward, and the Calibration of Engagement

Another basic aspect to consider in teaching in general an particularly in E-learning and E-teaching is Motivation which is is not an epiphenomenon of cognition but a neuro-modulatory condition. The amygdala hippocampus prefrontal triad, as reconstructed in chapter 2, coordinates salience appraisal, contextual binding, and top-down regulation (Immordino-Yang & Damasio, 2007; Pekrun, 2006; Pekrun et al., 2011). Moderate arousal tags experiences for consolidation; chronic stress, by contrast, erodes hippocampal plasticity and executive control (Lupien et al. , 2007). Online teaching oscillates between these poles: it can generate curiosity and agency (through autonomy, immediate feedback, and transparent progress), or it can amplify uncertainty and evaluative anxiety (through unstable technology, camera exposure, and ambiguous expectations). Digital platforms also concentrate on micro-rewards, instant quiz feedback, badges, streak counters that exploit dopaminergic prediction errors (Schultz, 2015). Properly tuned, these signals sustain effort and calibrate attention during practice; poorly calibrated, they bias behavior toward shallow, short-horizon tasks and weaken persistence when gratification is delayed. The UCLA students' testimonies are revealing: they appreciate frequent, low-stakes checks that inform self-regulation, yet they criticize gamified patterns that seem to replace depth with points. The faculty answers to the survey examined in chapter 3 mirror this ambivalence, praising just-in-time feedback while warning against designs that fragment intellectual labor. The didactic consequence is not to refuse micro-rewards but to insert them within a macro-structure that privileges cumulative accomplishment: capstone syntheses, multi-week inquiries, iterative revision cycles, and reflective prompts that convert immediate signals into a narrative of mastery (Immordino-Yang & Damasio, 2007; Pekrun, 2006). In other words, simpler terms, online engagement should alternate between small, frequent reinforcements and larger, long-term purposes, so that the quick emotional satisfaction provided by short rewards (linked to dopamine release) supports the consolidation of real learning in memory, instead of replacing it.

Social Presence, Interbrain Synchrony, and the Didactics of Recognition

Learning is always a social activity, even when confined in the digital world of online education. The literature synthesized in chapter 2, describes neural coupling between interlocutors as a substrate of shared understanding; interbrain synchrony predicts comprehension and engagement, and is typically stronger in face-to-face contexts (Dikker et al. , 2017). Videoconferencing , and by analogy e-teaching, by constraining non-verbal bandwidth and altering gaze dynamics, attenuates coupling; yet structured collaboration, low latency, and clear turn-taking recover a significant portion of the synchrony necessary for alignment. The UCLA student accounts insist on exactly these variables: responsive instructor presence, visible acknowledgment, small-group discussion with clear roles, and predictable synchronous touchpoints. The faculty echo the same pattern from their side, observing that when social presence was intentionally built into the course design through warm vocal tone, visible gestures during complex explanations, and ritualized moments for student questions, both participation and retention improved. These empirical observations align closely with theoretical models discussed in chapter 2: the brain's mentalizing networks, specifically the medial prefrontal cortex (mPFC), the temporo-parietal junction (TPJ), and the superior temporal sulcus (STS), remain active in online settings when the instructional environment makes the teacher's intentions clear and the sense of reciprocal interaction perceptible (Immordino-Yang & Damasio, 2007). The implication admits a simple formulation: presence online is produced, not presumed. Educators should design it through rhythm (regular office hours), form (instructor's visible face and hands during key moments), and structure (roles, norms, agendas). Far from being theatrical, such presence translates into better memory because recognition is itself a cognitive scaffold.

Multisensory Encoding, the Visual Advantage, and the Risk of Redundancy

In chapter 2 we discussed as vision dominates cortical real estate; dual-channel encoding yields richer traces than text alone when design aligns channels rather than duplicating content (Mayer, 2001, 2009; Mayer & Moreno, 2002, 2003; see also the "visual advantage" section in the chapter). Also, the analysis of UCLA's faculty and students surveys confirm that interactive multimedia when coherent improves immediate learning and delayed retention across domains; conversely, redundant narration and identical on-screen text can depress comprehension by overloading channels (Clark & Mayer, 2016; Mayer & Moreno, 2003). Students in the UCLA survey repeatedly point to well-paced visuals with synchronous narration, camera-visible demonstrations for procedural knowledge, and short pause-and-annotate intervals to reflect precisely the conditions that the theory predicts. What matters is not the abstract endorsement of "more media," but the discipline of alignment. Visuals should be explanatory rather than decorative; narration should complement rather than replicate; interactions should solicit generation (drawing, labeling, explaining) rather than passive clicking. When instructors in the UCLA faculty study adopt concise video explanations anchored to a single diagram, then request an immediate generative act (micro-essay, sketch, or narrated solution), they enact the canonical sequence: focused encoding, germane processing, and tagged retrieval (Mayer, 2009; Born & Wilhelm, 2012).

The Google Effect, Retrieval Practice, and the Architecture of Knowledge

The "Google effect" (Sparrow et al., 2011), examined in Chapter 2, plays a significant role in e-learning, as it reveals a cognitive shift from remembering the content itself to remembering where that content is located. In the context of online teaching, this becomes a genuine curricular choice: the instructor may either regret the externalization of memory or, more constructively, design assessments that intertwine internal recall with the intelligent use of external information sources. The UCLA students' preference for open-resource tasks that nonetheless demand conceptual explanation from memory suggests the didactic equilibrium: tests and activities should require core propositions to be retrieved without scaffolds, and extensions to be constructed through critical sourcing. Such an architecture aligns with reconsolidation dynamics: each retrieval destabilizes the trace and allows richer integration, especially if feedback is immediate and specific (Dudai, 2012; Born & Wilhelm, 2012). Online teaching platforms and instructors should enable this instrumentation of retrieval at scale. Short, frequent, low-stakes checks; spaced revisits of fragile concepts; and reflective prompts after practice are not marginal habits but the operationalization of memory science. Both UCLA groups endorse these practices: students because they calibrate effort; instructors because they supply analytics for timely adjustment.

Fatigue, Overexposure, and the Self-Regulatory Cost of the Interface

Another neuropedagogic concept to keep in mind for planning practical implementation of Online courses is the *"Fatigue"*. In digital learning is not merely the sum of hours on screen; it is the phenomenological expression of chronic control expenditure. We have seen in chapter two that e-learning fatigue synthesizes multiple strands: visual strain, constrained movement, non-verbal overload, and incessant self-presentation that converge in the label of "Zoom fatigue" (Bailenson, 2021). Students describe cognitive slowing and affective irritation after long synchronous blocks; faculty report diminished responsiveness beyond forty minutes without interactive resets. Such portraits match the attentional story told earlier and justify the insistence, present in both UCLA analyses, on temporal segmentation and camera-optional phases (intervals of the online lesson designed for private concentration) for reflection and writing. The didactic implication is practical and immediate: professors should plan for recovery, alternating modalities (listening, doing, discussing), providing movement of prompts, and inserting silent intervals for note-making to reduce continuous vigilance and allow the executive system to reset. These are not concessions to comfort; they are conditions for sustained depth and success in teaching effectiveness.

Educating Attention: Neuroplasticity and the Architecture of Online Courses

Teaching with digital technologies and particularly online involves to consider the main problem of attention. The brain's capacity to reorganize its synaptic architecture in response to repeated patterns of experience (neuroplasticity) reminds us that every educational environment must imply not only what students learn, but how they learn to learn (Dayan & Cohen 2011). Often, exposure to digital media is characterized by incessant novelty, rapid switching; these experiences direct neural pathways toward scanning rather than sustained focus, toward reactivity rather than reflection, and the mind adapts to the rhythm involved. The risk for online higher education, therefore, is not technological but ecological in the sense that it concerns the entire cognitive environment in which learning takes place. A course that multiplies tools, windows, and notifications gives to the brain discontinuity, rehearsing precisely the habits of fragmentation and perpetual sampling that undermine the formation of complex mental models. The reflections of UCLA faculty, who mainly advocate for *"fewer, better-integrated tools"* and *"quiet, single-stream pages,"* assume in this light an interesting neurological significance because such minimalist architectures cultivate attentional endurance and foster a mental environment in which deep understanding can develop. Designing an online course with neuroplasticity in mind means taking into account the brain's ability to sustain and modulate focus over time, but this requires regular rhythms, stable affordances (interfaces and tools that remain constant and predictable), and a gradual progression of complexity that allows students' neural and cognitive systems to adapt without overload. The fascination of novelty that often attracts instructors must therefore be approached with discernment; innovation, when it serves conceptual clarity and motivation, enriches the learning experience, but novelty introduced for its own sake distracts and destabilizes. In this sense, the instructional principles articulated by Mayer and Sweller that are at the base of this paragraph function not merely as guidelines for presentation but as exercises in attentional discipline. Each coherent layout, each measured transition, each reduction of extraneous load strengthens the learner's capacity to dwell, to persist, and to construct meaning in depth rather than in fragments.

Distraction, Inhibitory Cost, and the Economics of Suppression in E-learning

Another main theme discussed in literature is the distraction factor involved particularly while students attend a course online. It is not a neutral act in a digital environment to ignore an alert because it is an invisible labor of inhibition. The learner's brain must exert deliberate control to resist engagement when a message notification flashes in the corner of the screen or when an LMS banner announces a new post, or even when an email icon begins to blink during a lecture. The process in which the prefrontal cortex momentarily suppresses the impulse to attend to the competing stimulus is described by cognitive psychology as an *inhibitory process,* and it is far from effortless. This act draws on the same limited space of working memory (WM) resources required for comprehension and reasoning. Each episode of suppression carries a measurable cost that it consumes neural energy, reduces the capacity available for maintaining the current cognitive task, and subtly degrades concurrent performance (Hasher & Zacks, 1988; Gazzaley & Nobre, 2012). In practical terms, part of the mental bandwidth that should sustain understanding is momentarily diverted toward restraint even when a student successfully ignores a pop-up message during an online lecture. The thought continues, but with a small lapse, a missed nuance, a weaker connection, a fragmented chain of reasoning. The modern online classroom involves alerts and peripheral stimuli, which inadvertently transform attention into a form of continuous self-discipline. Also, the fact that it is almost normal for students to leave other web pages opened on the screen and to take look at their smartphones always ready for the favourite apps or social media. All these distractions should be discouraged by applying a kind of teaching *"netiquette"*. Taking into account the limits of working memory and the mental effort that every act of inhibition requires, it seems reasonable that also LMS should, as far as possible, protect the student from unnecessary disturbances. Notifications that appear at random, messages sliding on the side of the screen, or the soft chime of an incoming e-mail, all these little intrusions steal a fragment of attention. It would make sense for the LMS to silence such noise during an online lecture, maybe even to offer a *"focus mode"* in which the lesson fills the entire screen, leaving no room for temptation could improve learning. Yet we should be cautious applying so many limitations because to lock the student completely inside a digital cage, forbidding any movement beyond the lesson, would also mean denying moments of autonomy, the freedom to take a note elsewhere, to check a reference, to breathe intellectually. University education should develop the capacity to manage one's own attention, not simply to have it managed; teaching, after all, is not the training of obedience but the stimulus to self-regulation. Probably the wiser path lies somewhere in between an environment that is reassuring and uncluttered, but at the same time that trusts the learner's judgment.

Managing Stress, Uncertainty, and the Inverted-U of Performance

Studying online could involve stress as well as traditional classes, as seen in numerous studies about online lessons during the Covid 19 pandemic. This is connected with the neurobiological architecture of stress; the sympatho-adrenal-medullary (SAM) system, which generates the fast arousal of the organism through the release of adrenaline, and the hypothalamic-pituitary-adrenal (HPA) axis, which operates in a slower way, regulating the glucocorticoid hormones, together create what neuroscience describes as an inverted-U relationship between stress and performance. In simple words, it means that a certain quantity of stress can be useful, because it stimulates attention and motivation, but when the level passes a certain point, the cognitive functions begin to decline. In online teaching, this dynamic is very visible: a light tension before a live discussion or an exam can help students to be more alert, but continuous pressure, many strict deadlines, or the anxiety of an unstable internet connection produce the opposite effect, reducing concentration, memory, and the capacity for learning in an efficient way. (Vogel, 2016; McEwen et al., 2016). Often, professors who run courses online feel more responsible and propose much more activities and great amounts of tasks to students. The remedy is not merely technological redundancy but predictability; clear weekly rhythms, transparency about assessment criteria, fallback procedures for failure and rapid formative feedback that converts anxiety into information. When arousal is right-sized, it energizes learning; when it is ambient and chronic, it exhausts the very systems upon which learning depends (Pekrun, 2006; Pekrun et al., 2011; Immordino-Yang & Damasio, 2007).

Temporal Ethics of Coursework - Sleep, Circadian Alignment

Disigning courses to be released in synchronous or asynchronous or hybrid ways involves the consideration of the right temporal dimension. Sleep is a biological phenomenon where the consolidation of systems makes manifestation; when the study is at the wrong time and the student uses a computer at night, the blue light delays of melatonin, fragments slow sleep and causes damage to the capacity to memorize the next day (Gooley et al., 2011; Chang et al., 2015). The asynchronous modality has a special position with respect to the chronotype, and we can observe this in the UCLA student preference for deadlines with a window and synchronous sessions in the late morning. The survey of professors reveals a correlation between a regular rhythm and higher completion rates. So, the design also has a temporal dimension; we must avoid deadlines at night with high importance; we should promote early contact with downloadable materials; we must recommend hygiene for blue light; and we can use the functions of LMS that organize revision in time instead of all in one moment. In synthesis, the calendar can be a cognitive instrument, not only a bureaucratic thing.

Temporal Rhythm and Cognitive Segmentation in Online Learning

The preferences of UCLA's students and professors show a very coherent tendency: when lessons are divided into shorter, meaningful parts, punctuated by transitions that possess a clear intention, the results are consistently better than in long, uninterrupted monologues especially when each segment culminates in a brief cognitive act such as recall, application, or articulation. This preference, theorized by Mayer through his segmenting principle and by Sweller through his analysis of cognitive load (Mayer, 2009), 2021; Sweller, 2019), has, however, far deeper roots in pedagogical reflection. Since the early formulations of John Dewey, who saw learning as a rhythm of experience and reflection (Dewey, 1910, 1916), educators have recognized that understanding unfolds in cycles rather than in continuous exposition. The same intuition underlies the developmental stages described by Piaget (1952) and the spiral progression proposed by Bruner (1960), as well as Skinner's (1954) method of short, incremental learning steps reinforced by feedback. These early insights anticipated what neuroscience and cognitive psychology would later confirm: that attention, comprehension, and memory thrive within structured intervals of focus and rest. In this sense, the modern evidence gathered from the UCLA surveys appears as a neurocognitive corroboration of a long pedagogical heritage, and both students and faculty perceive that the alternation between short explanations, moments of activity, and reflective pauses reproduces the natural rhythm of learning itself-the same rhythm Dewey and his successors intuited long before neuroscience could measure it. In daily teaching practice, it would therefore be wise to design online lessons as articulated sequences of thought rather than as continuous discourses that last for hours like it happens in many university courses: brief expository windows followed by generative exercises, visual annotations, or micro-discussions allow attention to recover and memory to consolidate. Conversely, as already said, it would not be advisable to maintain an uniform timing extended monologue, as fatigue silently erodes comprehension and engagement. The pedagogical indications emerging from these reflections suggest that online teaching, when it mirrors the natural pulsation of cognition, transforms the screen from a flat surface of transmission into a dynamic environment where time itself becomes an ally of understanding.

Part III – Design and Implementation of Online Didactics

Having explored in Chapter II the neurocognitive foundations of mediated learning-the physiological, attentional, and emotional conditions that define how the brain learns online-this section turns to their pedagogical translation. Its purpose is not to restate those mechanisms, but to understand how they can be embodied in the design of online courses. The object here is the pedagogical architecture itself: how one organizes space, time, rhythm, and presence so that cognitive economy and intellectual depth coexist. While the previous part spoke the language of neurons, memory traces, and attentional systems, the present one speaks of pages, modules, voices, and screens. In this transition from physiology to design, each principle becomes an act of care: to teach online is not to transfer content, but to construct an environment in which understanding can emerge through deliberate spatial, temporal, and relational forms (Mayer, 2009, 2021; Sweller, 2019).

Design as Intellectual Care

To design an online course is, in the end, to practice a form of intellectual hospitality. The principles elaborated across these pages-stability, rhythm, representation, retrieval, presence, simplicity, temporal ecology, legible platforms, and dialogic evaluation-compose a single ethical framework: that of care for attention. The evidence from UCLA, interpreted through cognitive theory, converges with precision. Where design reduces extraneous load, students describe clarity; where teachers cultivate regular dialogue, neuroscience records synchrony; where structure is stable, the hippocampus encodes more efficiently (Mayer, 2009, 2021; Sweller, 2019; Dikker et al. , 2017). Pedagogical design, therefore, is not a secondary craft but the visible form of epistemic compassion. It shapes the environment so that cognition may flourish without waste. Instructors become architects of thought, institutions the stewards of the ecologies that sustain it. To teach online well is not to simulate presence but to invent it through form, rhythm, and care.

Designing the Course Space: From Cognitive Architecture to Didactic Topography

The first gesture of online pedagogy is architectural. A digital course is not a pile of materials but a space of orientation, and its coherence mirrors the hippocampal processes that tie content to context (Bellmund et al. , 2018; Dudai, 2012). Students, as the UCLA analysis shows, repeatedly associate learning effectiveness with the stability of the environment: when modules are recognizable, when icons recur, when the location of resources does not shift from week to week, comprehension increases. This is not a matter of convenience but of cognitive anchoring (Mayer, 2009). The layout of a course should therefore resemble a small geography of recurring rooms: one for orientation, one for exposition, another for practice and feedback. Instructors who maintained fixed weekly structures-announcements always on Mondays, discussions always in the same section-observed fewer logistical questions and more conceptual dialogue. Consistency is not monotony; it frees working memory from constant re-mapping (Sweller, 2019). Designing a course shell, then, is designing a mnemonic map that lets the learner inhabit knowledge rather than chase it.

Sequencing Knowledge: The Rhythm of Attention

Attention does not extend indefinitely; it pulses and renews itself. For this reason, the temporal form of a course must respect what neurocognitive research defines as the rhythm of vigilance (Posner & Rothbart, 2007). The most successful UCLA courses followed a recurring cadence: a short lecture, a generative task, a pause for reflection. Each segment marked an entrance and an exit, giving the mind time to stabilize meaning before moving forward. Segmenting instruction is not simplification, it is scaffolding. Mayer's segmenting principle (Mayer 2009) explains that the division of complex content into meaningful parcels helps students manage limited working memory. When instructors explicitly signal transitions "Now we move from definition to application", students anchor attention to structure, avoiding the fatigue of continuous exposition (Mayer & Moreno, 2003). The alternation of tempo, the conscious modulation of silence and speech, transforms the online lesson from a stream of information into a sequence of comprehensible acts. This is pedagogy as rhythm, the art of pacing comprehension rather than accelerating delivery.

Words, Images, and the Craft of Synchrony

Digital teaching seduces through abundance-videos, slides, infographics, overlays-yet comprehension depends on restraint. The Cognitive Theory of Multimedia Learning (Mayer, 2009, 2021) demonstrates that learning improves when verbal and visual channels cooperate rather than compete. UCLA students often complained of slides overloaded with text, while faculty noticed that minimal visuals synchronized with speech generated more engagement. The principle of coherence thus becomes a design ethic: nothing should appear on the screen that does not serve comprehension. In practice, this means showing diagrams as they are explained, aligning the narrator's voice with the visual revelation, and avoiding on-screen text identical to spoken words (Mayer & Moreno, 2003). Professors who adopted progressive disclosure, unveiling complex processes step by step, reported higher retention and more precise student questions. The screen, then, is not a stage for decoration but an instrument of synchronization. As Clark and Mayer (2016) note, visual parsimony and temporal alignment transform perception into cognition. The discipline of representation is thus the aesthetic face of cognitive ethics.

Retrieval and Feedback: The Dialogue of Memory

Memory is sustained by repetition, but only when repetition reconstructs meaning. Dudai (2012) and Born and Wilhelm (2012) remind us that every act of recall reopens a trace, allowing it to consolidate anew. Pedagogically, this means that assessment cannot be a terminal moment: it must be continuous dialogue. UCLA students praised short, low-stakes activities, micro essays, reflective quizzes, oral checks followed by rapid feedback. Faculty noticed that when responses arrived within forty eight hours, engagement increased and errors diminished. This reciprocity mirrors neural feedback loops: information given in temporal contiguity with effort refines the synaptic pattern (Pekrun, 2006). Feedback, in this sense, is not correction but modulation. It converts anxiety into learning energy, especially when phrased in terms of process how to improve, rather than mere outcome. Immordino-Yang and Damasio (2007) show that emotion and cognition coalesce when feedback acknowledges effort, generating the motivational tagging that sustains persistence. A course that breathes through retrieval cycles thus embodies the biological truth that understanding is built through revision, not through finality.

The Presence of Others: Designing for Recognition and Reciprocity

To learn is also to be recognized; even mediated through screens, education remains a social act. The research on neural synchrony (Dikker et al. , 2017) reviewed in chapter II, reveals that comprehension rises when teacher and students share rhythm and attention. Online teaching weakens such synchrony, but it can be deliberately reconstructed through design. Visibility, tone, and ritual become didactic tools: a visible face during explanations, consistent greetings at the start of sessions, the acknowledgment of student names, or the weaving of earlier contributions into the current discussion. In the UCLA surveys results, both professors and students agreed on the fact that classes where these gestures were present produced more coherent dialogue and less isolation. The instructors' voices, modulated and expressive, worked as cues of intention (Pekrun et al. , 2011); warmth teaching onlineis not sentimentality; it is information. The social presence built through these micro-acts operates as cognitive infrastructure, re-establishing the communicative synchrony that enables understanding. The pedagogy of recognition, therefore, does not belong to personality but to design: it is a structure of visibility that makes thought audible to itself (Immordino-Yang & Damasio, 2007).

Managing Cognitive Load

Every platform, every widget, every extra link consumes part of the learner's finite cognitive budget. Sweller (2019) and Skulmowski and Xu (2022) describe this as extraneous load-the friction that distracts working memory from meaning. The UCLA participants to the surveys articulated the same insight in empirical terms: *"too many tools, " "too many windows"*, are not beneficial. Courses that used a single, coherent interface fostered concentration and calm. Simplicity, therefore, is not minimalism but responsibility, in fact to remove what does not serve learning is to act ethically toward students' attention. The counter-argument that multitasking trains flexibility, finds little support in the evidence. Ophir et al. (2009) and Moisala et al. (2016) demonstrated that habitual multitaskers show higher distractibility and lower deep comprehension. The wise instructor limits novelty so that intellect may deepen. By curating fewer but better-integrated elements, design becomes a silent pedagogy of focus, teaching by example that complexity in thought requires simplicity in form.

Temporal Ecology: Pacing, Pause, and Biological Rhythm

Time in education is not neutral; it is biological. The regulation of alertness follows circadian and ultradian cycles (Gooley et al. , 2011). We've seen in chapter II as blue-light exposure at night disturbs sleep and memory consolidation (Chang et al. , 2015). Students at UCLA answering a specific question of the survey unconsciously echoed this research when they requested deadlines at reasonable hours and synchronous sessions in the late morning. Faculty who respected these rhythms expressed in the survey higher attendance and more consistent participation. Good design thus treats scheduling as pedagogy; assignments should be spaced, not clustered, sessions punctuated by moments of rest, long expositions interrupted by short writing or reflection tasks. Born and Wilhelm (2012) showed that spacing enhances retention and this result was confirmed in educational research (Cepeda et al. , 2006). Even a minute of silence after dense explanation can act as cognitive recovery. The rhythm of the course must breathe like a living organism, periods of intensity must be followed by repose, because learning, unlike machines, proceeds by oscillation, not by linearity.

Part IV – Evaluation, Well-Being, and Institutional Implementation in Online University Teaching

Evaluation in online university teaching reopens an old pedagogical question under new epistemological conditions: how to verify knowledge when the act of verification is technologically mediated. In the traditional classroom with the students present, proctorial norms (shared time, spatial ritual, tacit supervisory gaze) stabilize the meaning of the test; online environments dissolve those anchors, making the context of mediation part of the construct being measured. The practical consequence, seen in faculty and student reports at UCLA, is a dual anxiety: instructors worry about rigor without surveillance; students fear opacity and arbitrariness in algorithmically assisted judgment. The problem is not solely procedural; it is conceptual, for evaluation of online courses academia must reconcile trust and truth-credibility of process and validity of inference under conditions of mediation (Heil & Ifenthaler, 2023). In such settings, theory matters: the difference between summative and formative functions (judgment versus guidance) becomes not merely taxonomic but moral, because removing co-presence strips many of the social cues through which fairness is ordinarily perceived, thereby raising the premium on structured transparency and feedback. When learners

read identical rubrics online yet experience them as less transparent, the effect is motivational as well as epistemic, with predictable impacts on persistence and depth of processing (Morris et al. , 2021). In the American university tradition, assessment is rarely confined to a single high-stakes event; rather, it unfolds as a sequence of discrete tasks, quizzes, participation, projects, presentations each typically weighing from around 10% to 30% of the final grade. This structure allows feedback to be embedded in the learning process, gradually calibrating the student's trajectory and reducing the anxiety of being judged only once. By contrast, in many Italian universities the evaluative model remains largely summative: a final written text and an oral examination, all at once. Because the weight of the outcome is concentrated in one moment, the potential for iterative feedback is limited and the course of evaluation often tends toward judgment rather than accompaniment.
A neurocognitive lens clarifies why the stakes seem higher in online learning: evaluative episodes activate reward and stress systems, dopamine signaling for anticipated success, and cortisol-mediated pathways for uncertainty, so perceived unpredictability shifts affect from curiosity to anxiety, reducing the bandwidth available for reflection and long-term consolidation

That tilt is accentuated when mediation introduces lag, interface friction, or ambiguous norms (Immordino-Yang & Damasio, 2007). Consequently, the Constructive Alignment Imperative (a fundamental design principle developed by John Biggs , 1996) demands that a course's objectives, learning activities, and assessments must cohere. This tight alignment is crucial: it ensures that the student's cognitive effort is spent on sense-making, that is, on genuinely understanding the material, rather than on wayfinding or struggling to figure out the path to success. In disembodied courses like online learning ones , two factors are key to maintaining this necessary connection, acting as the "glue" (Mayer, 2021): multimodal signaling (using clear instructional cues across different media) and the tight coupling of task-feedback cycles (providing immediate and relevant

corrective guidance). The intrinsic philosophy of evaluation is the dialogue (Pekrun, 2006; Immordino-Yang & Damasio, 2007), but this philosophy puts in evidence how these two cultural models differ in practice and how online course design must respond accordingly. Practically, designing assessment as a conversation means diversifying formats: brief written reflections, annotated drafts, synchronous or asynchronous oral exchanges, each followed by timely commentary (Pekrun et al., 2011). In the U.S. model, this is quite feasible because multiple small-weight tasks integrate naturally into the semester. In the Italian system, making such integration realistic implies re-thinking the "single event" exam: universities must consider splitting evaluation into multiple moments or embedding formative checkpoints even within a summative frame. Before choosing instruments, evaluators must acknowledge cultural architectures of assessment that shape what "counts" as evidence of learning. In Italy, the traditional model historically marked by the prestige of ex tempore oral examination and integrative final tests privileges rhetorical synthesis and the public demonstration of mastery in a single terminal moment; in the United States, a Deweyan-Tylerian heritage of process-oriented, criterion-referenced assessment normalizes continuous, modular grading across multiple artifacts (e. g. , participation, short quizzes, projects, midterms) typically weighted in the range of 10-30% each. These genealogies matter online: Italy's summative emphasis risks transferring a single high-stakes event into a remote, surveillance-heavy setting, whereas U. S. practice maps more naturally onto LMS-mediated continuous assessment that disperses cognitive load and makes progress visible (Heil & Ifenthaler, 2023; Morris et al., 2021). A reform path for Italy, therefore, is not to abandon dialogic orality but to hybridize: retain viva voce depth while adding formative micro-assessments (short concept checks, low-stakes drafts, structured peer review) to reduce all-or-nothing volatility and align with memory and motivation dynamics well documented in online contexts (Morris et al., 2021; Mayer, 2021).
The American model uses these design features also for online courses more readily, but in Italy, the institutional obstacles, laws and regulations,

infrastructural inertia, regulatory constraints, faculty habit, block the adoption of new evaluation approaches. These structural conditions shape the feasibility of shifting toward dialogic, distributed assessment and influence how online redesign can be implemented sustainably. Within this comparative frame, the techniques and instruments of online evaluation become intelligible as cognitive-ethical choices. LMS-embedded quizzes (timed or untimed, randomized item banks), asynchronous peer review, and rubric-guided project work are not mere logistics; they are ways of externalizing executive functions—orienting attention, chunking tasks, and pacing retrieval, so that scarce cognitive resources serve understanding rather than navigation (Mayer, 2021). AI-assisted grading systems such as Gradescope can cluster similar answers, enforce rubric consistency, and cut turnaround time at scale, which is pedagogically non-trivial because delayed feedback degrades both retention and motivation in asynchronous cohorts (Singh et al., 2017). Discussion analytics and social-annotation platforms (e. g. , Perusall) make participation legible and provide micro-feedback on reading engagement; randomized controlled and quasi-experimental studies in university STEM courses show increases in pre-class preparation and conceptual performance when annotation is coupled with targeted prompts, effects that are particularly valuable online, where spontaneous co-presence cues are absent (Seaton et al., 2024). In each case, the evaluator's craft remains interpretive: the machine accelerates pattern detection; the teacher restores meaning, calibrating the next learning event to what students actually did and understood (Heil & Ifenthaler, 2023).Assessment for online courses demands not only pedagogical redesign, but rigorous academic-integrity mechanisms and attention to how these mechanisms interact with data protection regimes, especially in Europe. In the U.S., many higher education institutions deploy secure-browser technologies or remote-proctoring systems that lock the student's device into exam mode, restrict access to other applications or tabs, monitor webcam and microphone, and provide behavioral-analytics flags for suspicious activity (ExamSoft, 2025; Proctortrack, n.d.). Such systems support the shift from "open window" to "locked session" testing. In Italy and more broadly in Europe, however, the deployment of these tools is tempered by privacy-law concerns. For example, the Italian Data Protection Authority fined Università Bocconi € 200,000 in 2021 for using Respondus Monitor without sufficiently informing students and for processing biometric data without a valid legal basis under the GDPR (EDRi, 2021). Automated proctoring software has been criticized for gathering sensitive personal data, including video of the student's room, screen-recording, keystroke monitoring, and for requiring software installations that act like spyware (Wedermann , 2022). Modern AI-based systems such as YuJa Verity, Honorlock, or OctoProctor offer features like secure browser lockdown, detection of secondary devices, AI-assisted cheating detection , and identity verification via facial recognition. Yet the very capabilities that safeguard academic integrity also raise questions of proportionality, consent, and equity, especially when students lack adequate technology or are subject to invasive surveillance. These kinds of assignments significantly lower the advantage gained by generic copying, because the required work is deeply context-bound and, crucially, the process is visible. More importantly, I would argue these innovative assessment methods align perfectly with the broader goal of feedback literacy itself; they are fundamentally designed to teach students how to actively interpret and critically deploy, evaluative information, moving decisively away from the habitual treatment of grades as simple, terminal judgments (Morris et al., 2021). Of course, recognizing institutional constraints, the need for traditional closed-book certification is sometimes absolute. In those specific scenarios, the function of AI-assisted proctoring currently occupies a complex, highly contested middle ground, a situation demanding careful ethical scrutiny. Systematic reviews demonstrate the technology's wide adoption within distance education, yet they simultaneously underscore significant ethical hazards: issues of privacy, inherent bias, and proportionality are paramount, alongside documented cognitive side effects. These include heightened stress and acute attentional narrowing under surveillance, even among honest test-takers (Nigam et al., 2021). This tension echoes broader debates on academic integrity. For these reasons, it would be reasonable to keep attention to behavioral signals, such as interaction anomalies or unique keystroke rhythms which are are clearly preferable to deeply invasive biometrics. Crucially, human evaluation must remain paramount, technological tools should aim to enhance educators' discernment rather than institutionalise automated suspicion (Nigam et al.2021) (Heil and Ifenthaler 2023) . For online courses evaluation, therefore, it should be essential not only to adopt the philosophy of evaluation as dialogue but also to attend to integrity systems that are culturally, legally, and ethically appropriate. In many cases, open-book assessments, randomized question banks, or live oral checks may serve as alternatives or complements to full-blown proctoring lockdowns. These modalities are less dependent on invasive surveillance tools and accommodate European data-protection regimes more comfortably while still safeguarding the legitimacy of certification. The integrity space extends beyond detection to education. Plagiarism-screening with AI-writing indicators (e. g. , Turnitin) can be part of a formative workflow that teaches the difference between paraphrase and synthesis and makes citation an explicit cognitive act; current reviews warn against over-reliance due to false positives and possible bias, reinforcing the need to position detectors as diagnostic prompts for teacher-student dialogue rather than as definitive adjudicators (Cotton et al. , 2023; Elkhatat et al., 2024). In parallel, adaptive feedback engines that flag conceptual gaps or method errors can help instructors triage large volumes of online submissions and return timely, specific comments; when those comments are coupled with multimodal responses (short audio/video explanations), students report higher perceived fairness and relational presence effects predicted by modality and signaling principles and consonant with affective-neuroscience claims that effective feedback is as much felt as it is parsed (Mayer, 2021; Immordino-Yang & Damasio, 2007). Well-being is not ancillary to evaluation design; it is intrinsic to validity online. Fragmented attention, constant context-switching among tabs, dashboards, and chats, taxes executive control and depletes motivational tone; empirical classroom studies of attention synchrony show that shared focus and social acknowledgment modulate engagement, which helps explain why frequent low-stakes, visible interactions (polls, micro-reflections, brief oral checks) stabilize learning in virtual cohorts (Dikker et al., 2017; Morris et al., 2021). Institutions should therefore schedule sustainable evaluation rhythms, staggered deadlines, coordinated assessment calendars across courses, and collaborative grading teams, so online exam periods do not become cognitive sinkholes for faculty or students. Here, AI can relieve friction by clustering similar feedback needs, templating rubric comments, and routing cases that need human conversation, shortening the interval between effort and response without displacing instructor judgment (Singh et al., 2017 ; Heil & Ifenthaler, 2023). All of these choices sit inside an ethical frame that must be explicit in online teaching. Recent European guidance on the use of AI and educational data emphasizes human agency and oversight, privacy and data governance, transparency, fairness, and accountability as core requirements; in practical terms this means disclosing when recommendations or scores are machine-generated, explaining the logic at a level students can understand, and offering accessible avenues for contestation or human review (European Commission, 2022). Such transparency is not a nicety; it is a condition of trust, the currency of digitally mediated assessment. It also constrains instrument choice: if a surveillance-heavy technique yields marginal validity gains at the cost of privacy and heightened stress, it fails proportionality; if an analytic tool cannot be explained without specialist knowledge, it fails transparency. The standard for adoption, then, is cognitive and ethical efficiency: each tool must reduce extraneous load, improve the precision or timeliness of feedback, and protect dignity in use (European Commission, 2022; Mayer, 2021).Against this backdrop, the Italian - American comparison becomes an opportunity rather than a clash. Italian universities can preserve the intellectual virtues of orality, hermeneutic depth, and synthetic argument while adopting a modest distribution of graded components, e. g. , three to five formative checkpoints (each 10-20%) plus a culminating oral/written defense, implemented through LMS and light-touch AI supports. Such a model retains identity while addressing the volatility and opacity of single-shot exams online; it also fits what we know about spacing, retrieval, and affect in mediated contexts (Morris et al., 2021; Mayer, 2021). U. S. institutions, conversely, can borrow from the Italian tradition by preserving high-challenge oral defenses (synchronous or recorded) within otherwise modular systems, which helps discourage over-instrumented micrometric. In both settings, authentic tasks and portfolio trajectories should anchor certification where feasible; proctoring and detection remain last-resort safeguards with human review and clear redress, not default modalities (Heil & Ifenthaler, 2023;). Put operationally, as evaluation guidelines for online courses, the synthesis is straightforward; professors should begin with constructive alignment: declare what learners must be able to explain, solve, design, or critique; choose assessment artifacts that instantiate those verbs in the online medium; and schedule low-stakes, frequent checkpoints that surface misconceptions early and protect motivation (Mayer, 2021; Morris et al., 2021). Academia could use AI where it demonstrably reduces friction (clustering, rubric consistency, analytics that reveal unseen participation patterns) and where its logic can be explained to students; insist on human interpretive sovereignty for consequential decisions. Universities could prefer behavioral-signal proctoring with strict minimization of intrusiveness; publish a data-governance notice (what is collected, why, retention, who sees it) at course outset; and provide multimodal feedback to preserve tone and presence across distance (European Commission, 2022; Immordino-Yang & Damasio, 2007). Finally, pace the semester: coordinate due dates within programs, staff collaborative marking where scale demands, and build short, reflective debriefs after major assessments to convert evaluation into sense-making rather than mere scoring (Heil & Ifenthaler, 2023; Dikker et al., 2017).

To evaluate the output of online courses is to design for care under mediation: every grade is a message, every rubric a narrative about what the institution values, clarity or opacity, dialogue or suspicion, growth or gatekeeping. When online assessment honors human agency with transparent AI support, distributes challenge across time, and privileges authentic production over brittle recall, rigor and empathy can coexist. The future of online evaluation will not be secured by software alone; it will be secured by trustworthy processes, transparent, proportionate, cognitively sound, in which intelligent tools extend, rather than eclipse, the examiner's judgment and the student's dignity (European Commission, 2022; Elkhatat et al., 2024).

Final considerations

Guidelines are epistemological instruments, not recipes. They do not dictate a single method; they articulate the conditions under which methods remain faithful to how minds learn in mediated environments. Their function is to translate concepts into operations: to move from what research shows about attention, memory, emotion, and social synchrony to what a teacher does, when, and why in a digital course. In this sense, these guidelines try to embody the collective intelligence of past inquiry, distilling theoretical and empirical knowledge into usable design sense for practice (Mayer, 2021; Sweller, 2019). When they are anchored in evidence, for example, in the convergences between the UCLA surveys and established cognitive principles of signaling, segmentation, and multimodality-guidelines preserve complexity while offering orientation, avoiding both over-simplification and paralysis (Dikker et al., 2017; Mayer, 2021). Where guidelines are absent, pedagogical entropy follows: each instructor reinvents what others have already learned, courses drift into idiosyncrasy, and students carry the cognitive cost of navigating inconsistency (Heil & Ifenthaler, 2023).This entropy is visible whenever digitally delivered teaching imitates the analog classroom as if the medium did not matter-an artifact not of stubbornness but of epistemological inertia. Minds conserve familiar actions; they defend accustomed schemas; they default to what once worked, even when the ecology of attention has changed (Immordino-Yang & Damasio, 2007). The price is a misalignment between teaching form and cognitive form: designs that once leveraged co-presence now overload working memory, scatter attention, and thin social meaning online. Guidelines mediate between theory and habit, scaffolding change without shaming experience; they make adaptation thinkable and doable by offering principled flexibility, clear reasons, bounded choices, and room for disciplinary voice (Mayer,2021). Two examples show how the principle translates into good practice. The segmenting principle argues for bounded temporal units, each with an entrance, an internal arc, and an exit-especially online, where vigilance decays more quickly and retrieval strengthens memory when spaced (Mayer, 2021). The redundancy principle warns against speaking text that is simultaneously on screen; duplicate verbal streams compete, split attention, and depress comprehension, particularly in mediated settings (Mayer, 2021; Sweller, 2019). These are neurophysiological imperatives, not stylistic tastes. Where they are ignored, the pattern reported in the UCLA student data reappears: fatigue accumulates, orientation slips, and presence feels thin (Morris et al., 2021). Yet guidelines do more than solve logistics; they carry symbolic and philosophical weight. They can embody the university's commitment to coherence, continuity, and care, signaling to faculty and students that meaning, not mere throughput, anchors instructional design. In this register, guidelines assert understanding over information and meaning over data, reminding us that teaching is not content shipping but the orchestration of sense in time (Immordino-Yang & Damasio, 2007). Well-made guidelines link the architecture of technology and the architecture of mind: the LMS sidebar, the rhythm of modules, the choreography of feedback all echo what cognition can bear and what emotion requires (Mayer, 2021). Treated as living documents, they adapt dynamically to new evidence, new tools, and new cohorts without surrendering to fashion (European Commission, 2022). In this light, true innovation is humility: the willingness to relearn how learning happens and to let that knowledge reshape instruction.To teach in digital space is not a transposition of traditional analogical lessons, but a reconfiguration of attention, memory, social attunement, and presence. The grammar of cognition shifts when ritual, place, and body are no longer the default anchors; the phenomenology of presence shifts when recognition is signaled through latency-ridden pixels rather than a shared room (Dikker et al. , 2017). This is rightly called a neuro-didactic mutation: a reorganization of the cognitive conditions under which understanding stabilizes and transfers. Digital environments become laboratories of this mutation by reshaping how students encounter knowledge (through interfaces and rhythms) and how teachers perceive agency (through analytics, mediation, and new forms of feedback). The university's mission adjusts accordingly: less a bounded place, more a network of presences enacted through attentional design and ethical care. From this mission, follow the ethics of digital pedagogy; adopting guidelines is not merely technical; it is ethical work. Every online course invokes a double responsibility: truth fidelity to the logic and structure of concepts and care attention to the cognitive and affective costs borne by learners (European Commission, 2022). In this framework, teaching becomes cognitive mentoship, the active shaping of a habitat where concentration can hold, curiosity can flourish, and difficulty can be faced without needless friction. Ethics takes shape as a balance between mind, environment, and learning, a kind of cognitive ecology that aligns with the proportioning of effort, the transparency of procedures, the pacing that respects saturation and recovery (Mayer, 2021).UCLA's student and professor surveys confirm these ethics. Students' requests for clear expectations, steady pacing, and visible instructor presence are best read as claims to cognitive justice, the right to learn in conditions tuned to human attention and emotion (Morris et al., 2021). Faculty calls for training and institutional backing similarly speak to epistemic dignity, the right to teach with authenticity rather than under a burden of improvisation or surveillance (Heil & Ifenthaler, 2023). Together these claims sketch the moral coordinates of mediated education, where efficiency must be balanced by empathy, structure by freedom, innovation by integrity (European Commission, 2022). Beneath these ethics lie the neurocognitive foundations that make them nonnegotiable. Learning is affectively charged; cognition and emotion form a single system, so that how a course feels is part of what it teaches (Immordino-Yang & Damasio, 2007). The instructor's task is to orchestrate "*affective resonance*" (emotional attunement between teacher and student), binding attention to meaning so that information has a place to land. Online, this resonance must be engineered: tone of voice, facial expressivity, pacing that alternates work and recovery, visual design that signals structure, and modality choices that avoid overload (Mayer, 2021). What co-presence once supplied by default must now be designed with intention. Hence the necessity of guidelines: they systematize this orchestration, making craft shareable and scalable.The UCLA surveys exposed in chapter III and IV, sharpen the portrait. Faculty report ambivalence: the relief of flexibility and reach set against the loss of immediacy and the thinness of mediated reciprocity. Many miss the tactile rhythm of in-person dialogue, the mutual calibration of gaze and gesture. Students, for their part, value autonomy and personalization while describing cognitive isolation, the sense of being less seen and less accompanied in thought. Between these views lies the practical challenge of our era: how to restore presence without bodies, how to translate empathy into code so that attention is held and intellect recognized (Morris et al. , 2021; Dikker et al. , 2017).Here the role of technology enters with clarity and proportion. AI, VR, and LMS platforms widen the design space but do not replace ethics; their valence depends on intentional integration (European Commission, 2022). Used well, they extend cognition: analytics surface participation patterns otherwise invisible; adaptive pacing aligns practice with forgetting; immersive scenes situate concepts spatially; timely feedback shortens the gap between effort and response (Mayer, 2021; Heil & Ifenthaler, 2023). Guidelines are the hinge: with them, technology becomes an instrument of enlightenment, assisting alignment between objectives, activities, and assessments; without them, tools dictate practice rather than serving pedagogy (Morris et al. , 2021).The institutional implications are direct. The goal is not to accumulate platforms but to cultivate a neuro-didactic ethos a shared culture of design grounded in how minds learn online. This ethos should permeate faculty development, instructional design services, and accreditation criteria, so that cognitive and ethical standards become baseline expectations rather than individual heroism (Heil & Ifenthaler, 2023; European Commission, 2022). Professors need cognitive literacy an explicit grasp of attention, memory, and emotion in mediated contexts so that choices about sequencing, modality, and feedback become principled rather than habitual (Mayer, 2021; Immordino-Yang & Damasio, 2007). Such literacy restores humanistic dignity to teaching: it recovers the sense that the transmission of knowledge is also a transmission of self, even and especially at a distance. All of this culminates in a renewed understanding of academic presence. Presence equals attention, not proximity. The essence of teaching is the reciprocal recognition through which understanding comes alive, what matters is the attentive gaze-the listening faculty of consciousness by which a learner feels seen and a teacher feels reached (Dikker et al.,2017). Neuroscience shows that *"resonance"* (Shared emotional and cognitive alignment), underwrites learning; pedagogy of online teaching must therefore cultivate resonance ethically, not through spectacle but through proportion, rhythm, and acknowledgment (Immordino-Yang & Damasio, 2007). Attention, emotion, and meaning are not parallel streams but the substance of presence itself. Thus digital learning redefines presence rather than abolishing it: it makes visible that learning has always been a dialogue of consciousnesses, not a choreography of bodies. Online teaching effectiveness depends on humanizing technology rather than technologizing lessons, building systems that honor empathy and depth over mere precision and speed (European Commission, 2022). The science of learning must serve the art of teaching, and the art of teaching renewed by science can restore the university's original vocation: to form minds that are not only informed but alive (Mayer, 2021; Immordino-Yang & Damasio, 2007).

CONCLUSIONS

In drawing together, the various strands of this research, it becomes possible to discern, with a degree of retrospective clarity that was not available during the often meandering and uncertain phases of research, the intellectual coherence that binds together its diverse theoretical explorations, neurocognitive analyses, empirical investigations, and institutional reflections. What began as arelatively broad and deceptively simple research problem, namely, how university-level online teaching might be conceived and implemented in a manner that is simultaneously grounded in established learning theory, aligned with contemporary neuroscience, responsive to the lived experiences of students and instructors, and coherent with institutional and ethical frameworks, has unfolded, chapter after chapter, into a complex inquiry whose resolution requires attention to multiple epistemic layers In retracing the argumentative path, one notices that the theoretical reconsiderations undertaken in the early phase of the dissertation were not intended merely as an introductory gesture, but rather as an indispensable point of departure for addressing the core question. The reinterpretation of classical learning theories, behaviorism, cognitivism, constructivism, socio-constructivism, proved necessary for understanding how pedagogical principles adapt when transferred into an environment where the affordances of co-presence can no longer be taken for granted. It became evident that models such as Backward Design (Wiggins & McTighe, 2005), Universal Design for Learning (Meyer et al., 2014), and Merrill's First Principles (Merrill, 2002, 2013) cannot simply be applied to online contexts as if these were neutral containers of content. Their epistemic assumptions shift subtly but significantly in mediated environments: instructional coherence must be designed rather than emerging organically from classroom interaction; multimodality must be orchestrated with respect to cognitive constraints rather than deployed as an aesthetic flourish; and the relationship between task, scaffolding, and assessment acquires new contours when the learner's perceptual world is flattened into screens and symbolic interfaces. As a result, the first research question, concerning how classical theories and instructional design models must be reinterpreted within digitally mediated environments, finds its answer in the recognition that these theories remain indispensable, yet must be reframed around the epistemology of mediation. They continue to offer the conceptual grammar of pedagogy, but their application requires an attentiveness to structural conditions that are not present in face-to-face learning. In this sense, online pedagogy becomes not the translation of traditional models, but their reinterpretation in light of what becomes pedagogically possible, and pedagogically impossible, when co-presence is replaced by designed presence.

A second axis of inquiry, developed at length in the neurocognitive analyses that followed, offered a complementary perspective by situating learning in the biological substrate that underlies all human cognition. The literature on multimedia learning (Mayer, 2002, 2009, 2014), cognitive load (Sweller, 2011), memory consolidation (Diekelmann & Born, 2010), emotional regulation and social cognition (Immordino-Yang & Damasio, 2007) provided a critical framework for evaluating the promises and pitfalls of online learning. Far from being a simple augmentation of traditional pedagogy, online learning introduces specific cognitive challenges: heightened susceptibility to distraction; increased inhibitory effort; reduced spatial cues; compressed affective signals; and the constant tension between autonomy and overload.

The dissertation's second major research question, how neurocognitive mechanisms constrain and enable online learning, finds its answer precisely in this intersection of vulnerability and opportunity. The neurocognitive evidence makes clear that online learning is not inherently inferior to in-person instruction; rather, it becomes effective only when instructional design aligns with the biological architecture of attention, emotion, and memory. Conversely, when design neglects these constraints, through excessive multimodality, poorly segmented materials, unbounded synchronous sessions, or insufficient social recognition, learning becomes fragile, effortful, and ultimately unsustainable.

What emerged from the neurocognitive analysis, however, was not simply a catalogue of limitations, but also a set of generative insights. Digital environments allow for temporal flexibility, personalized pacing, intentional multimodality, structured retrieval, and forms of reflective distance that are more difficult to achieve in physical classrooms. In other words, the neurocognitive evidence does not dictate pessimism; it delineates the conditions under which online learning can thrive. And those conditions later reappeared, almost verbatim, in the empirical responses of students and instructors. Indeed, when the dissertation turned toward the empirical investigations conducted at UCLA, the theoretical and neurocognitive foundations found resonance in the lived experiences of learners. The third research question, how course design, peer interaction, and student involvement shape perceptions of online learning, was answered through a rich set of findings that complicate simplistic narratives about "digital natives," "screen fatigue," or presumed preferences for hybrid formats. Students did not evaluate modalities in abstract terms; they evaluated the quality of design. They responded positively to online learning when course structures were intelligible, when multimodal materials were complementary rather than redundant, when synchronous and asynchronous moments were balanced, when peer interaction fostered recognition rather than anonymity, and when assessment was transparent and fair. Conversely, their dissatisfaction arose primarily in courses where design lacked coherence, where cognitive load was unmanaged, or where interaction felt perfunctory. In this respect, the empirical findings affirm the theoretical and neurocognitive analyses: online learning is not inherently disembodied or disengaging; it becomes so when instructional design fails to create cognitive, emotional, and social scaffolding. Students articulated repeatedly that online learning can be as effective as, and in some contexts more effective than, traditional instruction, provided that design responds to their needs in a systematic, evidence-informed manner. The faculty survey offered a distinct but related perspective, answering the fourth research question concerning instructors' perceptions of online teaching and the degree to which these perceptions align with evidence-based principles. Here, the findings were more ambivalent. Many instructors recognized the potential of online teaching, particularly its flexibility, accessibility, and capacity for multimodal representation. Yet they also expressed concerns regarding spontaneity, attention, academic integrity, technological demands, and the risk of student detachment. These concerns were not unfounded; they reflected real differences between embodied and mediated pedagogies. At the same time, several faculty intuitions aligned closely with theoretical and neurocognitive best practices: the need for clear structure, varied assessment, pacing, interactive strategies, and well-designed LMS environments. This partial alignment, neither full convergence nor full divergence, reveals the ecological condition of contemporary university teaching: instructors are often aware of pedagogical principles but operate within institutional contexts that do not consistently provide the training, support, or cultural orientation necessary to apply them systematically. The misalignment, therefore, is not attributable to resistance but to structural gaps that the guidelines developed in the final chapter seek to address.

The final research question, concerning the construction of institutional guidelines for online teaching, finds its answer in the synthesis offered in Chapter V. The guidelines do not present themselves as universal templates but as a situated framework grounded in the interplay of theory, neuroscience, and empirical experience. They articulate epistemological principles, neurocognitively informed design strategies, guidelines for multimodality and platform architecture, recommendations for assessment and academic integrity, and considerations related to affective and cognitive well-being. Crucially, they also address emerging issues such as the pedagogical use of artificial intelligence, the ethical handling of data, and the institutional responsibilities required to sustain a culture of digital pedagogy. Here the dissertation responds explicitly to the overarching research problem: an effective framework for online university teaching emerges only when design is intentional, evidence-based, ethically grounded, and institutionally supported. Without this integrated approach, universities run the risk of repeating the fragmented, emergency-driven practices that characterized the early phases of the pandemic. With such an approach, however, online education can become a legitimate pedagogical modality in its own right, capable of supporting deep learning, fostering equity, and expanding the epistemic possibilities of higher education. Naturally, no dissertation can exhaust a field as dynamic and multifaceted as digital pedagogy. The limitations acknowledged throughout the work, restricted institutional scope, evolving technological landscapes, the uneven granularity of neurocognitive evidence, invite, rather than foreclose, future research. Comparative studies across disciplines and institutions, longitudinal analyses of hybrid learning trajectories, experimental investigations into neuroinformed instructional strategies, and deeper inquiry into the pedagogical implications of generative AI represent promising paths forward. Yet the trajectory traced here suggests that online learning, when designed with cognitive, emotional, and ethical intentionality, can transcend its reputation as a contingency measure. It can become a space in which the university reinvents itself: a space that demands intellectual care, that cultivates presence without physical co-presence, that rethinks the rhythm of academic life in light of human cognitive limits, and that acknowledges learners not as passive recipients of content but as embodied, emotional, socially situated minds navigating complex environments. If this dissertation has contributed to articulating such a vision, one in which theory, neuroscience, lived experience, and institutional practice are brought into meaningful dialogue, then it will have fulfilled its purpose. The conclusion, therefore, is neither an end nor a summation, but a point of departure for a broader pedagogical reflection. For in the rapidly evolving landscape of higher education, the question is no longer whether online teaching will persist, but whether universities are prepared to meet its challenges with the intellectual seriousness, ethical attentiveness, and scientific literacy that twenty-first-century learning demands.

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