3 Digital Games and Contemporary Learning Environments

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3.1 Digital Games in Learning Contexts

This chapter situates game-based learning within digital environments, video games, artificial intelligence, motivation, and the cooperative or competitive structures that shape contemporary educational design.

Video games combine advanced human–computer interaction with sophisticated visual processing technologies, and have found significant application across education, healthcare, sports, and professional training. Research on their cognitive effects has revealed effects beyond domain-specific knowledge: Feng, Spence, and Pratt (2007) found that even brief exposure to action video games significantly reduced gender differences in spatial cognition, suggesting that game-based training can address systematic gaps in cognitive skills that have real consequences in fields such as engineering, mathematics, and the sciences. Research by Pérez-Marín et al. (2020) illustrates this potential through a

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multimodal instructional approach that integrates visual, auditory, and literacy-based learning channels. Designed with attention to learners' cognitive habits and expectations, the method was empirically tested with a cohort of students in a digital teaching environment, yielding measurable improvements in overall learning outcomes and a predictive accuracy of approximately 77 per cent.

A complementary line of research explores the application of deep reinforcement learning to video game environments in the context of musical instrument training. Dong (2023) describes a system in which a game agent's decisions guide the learner's actions in real time, combining deep learning with reinforcement learning to construct an adaptive gameplay algorithm. In this framework, reinforcement learning operates through three core elements: action, reward, and observation. The agent cannot access complete environmental information directly; it must instead rely on observation to infer the state of the system. Because no single prior-knowledge policy can fully specify optimal behaviour across all scenarios, the system generates and refines scripts from sampled combinations of actions, rewards, and observations. In practical terms, when a learner's performance meets the expected standard, the system provides positive feedback and appropriate rewards; when performance falls short, the feedback loop guides further adjustment. The overall outcome is a dynamically calibrated learning experience in which the game agent continuously optimises the learner's trajectory toward mastery.

This case should be read through a dual lens: gaming culture on one side and learning systems on the other. It shows how a digital game can operate not merely as entertainment, but as a complex social environment in which patterns of behaviour are continuously produced, reinforced, and potentially transformed.

From a gaming perspective, *League of Legends* exemplifies a highly competitive and cooperative structure. Its design requires players to act under pressure, coordinate rapidly with teammates, and manage the consequences of individual error within a collective framework. This combination is central to the game's appeal, yet it is also one of the principal sources of tension. In such an environment, frustration is rarely private: it becomes social, immediate, and visible through interaction. Toxicity, therefore, should not be understood simply as a moral failure of isolated individuals, but as a phenomenon partly embedded in the architecture of competitive multiplayer play itself.

What makes Riot Games particularly noteworthy is that it does not frame toxicity solely as a disciplinary issue. Rather, the company approaches it as a problem of human behaviour, one that can be studied, interpreted, and reshaped. This marks an important conceptual shift. Instead of assuming that online hostility is generated only by a small minority of pathological 'trolls', Riot's research suggests that most toxic behaviour emerges from ordinary players

experiencing moments of stress, anger, or disappointment. Such a finding is profoundly important. It implies that antisocial conduct in online games is not an exception produced by a deviant fringe, but a situational response that can arise within the average participant when the environment activates frustration.

Seen through a learning-oriented framework, this insight opens a broader pedagogical question: if behaviour can deteriorate under certain design conditions, can it also be improved through intentional design? Riot's experiments suggest that it can. By drawing on psychological principles such as priming, the company treats the game not only as a competitive platform but also as a space for behavioural intervention. In this sense, game design becomes a subtle form of educational design. The objective is no longer limited to teaching players how to win more effectively; it extends to shaping how they communicate, collaborate, and regulate emotion in shared digital spaces.

This is where the passage acquires particular depth. Learning, in this context, is not formal instruction but social conditioning through experience. Players are constantly learning what kinds of behaviour are tolerated, rewarded, ignored, or discouraged. Every interface choice, moderation system, and pre-game message contributes to an invisible curriculum of online conduct. Riot's work demonstrates that digital environments teach, even when they do not explicitly present themselves as educational. They teach habits of reaction, norms of interaction, and models of community.

The openness of Riot's research further strengthens the importance of the case. By sharing findings with academics and external collaborators, the company positions the game as a large-scale behavioural laboratory, one capable of generating insights that reach beyond the boundaries of e-sports. This makes *League of Legends* an especially revealing case study for anyone interested in digital citizenship, online learning communities, or the ethics of platform design. The game becomes, in effect, a microcosm of the internet itself: a place where cooperation and hostility coexist, and where systems can either intensify conflict or redirect it toward more constructive forms of engagement.

Ultimately, the passage suggests that the future of online gaming cannot be separated from the question of how people learn to live together in virtual spaces. A successful game is not only one that attracts millions of players or generates enormous revenue, but one that understands that player experience is inseparable from the quality of social relations it produces. In that sense, Riot's work points toward a larger truth: digital platforms do not merely host behaviour, they actively shape it. And if they can shape it negatively, they may also be designed to cultivate empathy, restraint, and cooperation.

3.2 The Video Game as a Designed Experience

If it is true that the educational strength of designed play lies in its capacity to hold together intentionality and openness, then the videogame today represents its most evident and, in many respects, most mature expression. Not because it is intrinsically superior to other forms of play, but because it renders visible and practicable on a large scale that tension between structure and freedom which characterises every meaningful ludic experience.

The video game is born entirely as an artificial product. Understanding why games engage so powerfully requires attention to the psychology of the player as much as to the design of the system: Hodent (2020) draws on cognitive psychology, neuroscience, and UX research to explain the perceptual and motivational mechanisms that make game experiences compelling, arguing that effective game design is ultimately applied cognitive science. Madigan (2016) approaches the same question from the perspective of social and motivational psychology, documenting how variable reward schedules, social comparison, mastery orientation, and the need for competence and autonomy shape player behaviour in ways that have direct implications for instructional design. Neuroscientific research lends substance to this characterisation: Palaus et al. (2017), in a systematic review of neuroimaging studies of video gaming, document consistent patterns of structural and functional neural change associated with gaming experience, particularly in regions governing attention, visuospatial processing, and cognitive control. The broader neuroscience of learning provides essential context: Dehaene (2021) identifies attention, active engagement, error feedback, and consolidation as four pillars of effective learning, and these map with remarkable precision onto the structural features of well-designed educational games. Carey (2015) adds that the conditions under which learning feels hardest, varied, spaced, and effortful, are often those under which it becomes most durable. Game-based learning naturally instantiates many of these conditions through variable challenge, interleaved skills, and continuous retrieval during play. At the behavioural level, Green, Li, and Bavelier (2010) demonstrated that action video game playing drives perceptual learning that transfers beyond the game to untrained tasks. Blumberg (2011) and Blumberg et al. (2013) further show that recreational game play deserves serious attention for its relationship with cognitive skill acquisition, particularly in attention, spatial reasoning, and executive function. Every component of the video game is designed: rules, environments, timing, feedback, and possible paths. Nothing is left to chance, and yet nothing is completely determined. It is in this paradox that the video game finds its strength: it constructs a

possible world, a coherent system that invites action and exploration, and the player inhabits an experience designed to be traversed.

One of the reasons for the extraordinary spread of videogames lies precisely in this capacity to adapt to the rhythms of contemporary life. They can be played in brief sessions or in prolonged immersion, in solitude or in relation, asynchronously or collectively. The time of play is not imposed from outside, but negotiated by the experience itself. In this elastic time, learning ceases to be a linear path and becomes an iterative process made up of attempts, errors, returns, and progressive discoveries. The videogame does not necessarily accelerate learning, but it makes it inhabitable.

Accompanying this temporal flexibility is the extraordinary breadth of the playing population. Videogames no longer belong to a specific age range or social group. Children, adolescents, adults, and older people access them with different motivations, competencies, and expectations. Yet within the same ludic structure, each constructs a singular path. The game is the same; the experience never is. It is here that the non-homogenising reproducibility characteristic of designed play becomes evident: what repeats is the frame, not the lived experience.

Price and technological accessibility further contribute to this diffusion. Mobile devices, flexible distribution models, and intuitive interfaces lower thresholds of entry and make videogames an everyday presence. But accessibility is not only an economic or technical question. It is also a cognitive one: progressive tutorials, immediate feedback, and support systems allow the player to learn while playing, without the need for explicit mediation. Knowledge is not explained, but shown; not imposed, but discovered.

As a global product, the videogame crosses geographical and cultural boundaries, speaking a visual and interactive language that often precedes the verbal one. Yet this globality does not produce uniformity. The same mechanics take on different meanings depending on context, cultural practices, and communities of reference. Videogames thus demonstrate that it is possible to design scalable experiences without erasing difference, offering common structures that accommodate plural interpretations.

The centrality of visual and sensory content further strengthens this experiential dimension. In the videogame, rules are not only declared, but embodied in environments, movements, and sounds. The consequences of actions are visible, immediate, often reversible. This makes learning a situated, concrete experience, deeply linked to action. One learns by doing, but also by observing, anticipating, and interpreting signals. The intelligence required is not only logical, but perceptual, emotional, and strategic.

One of the most significant aspects of the videogame, in this perspective, is its capacity to adapt to the player. Dynamic difficulty

levels, alternative paths, and personalised progression systems allow the experience to maintain a delicate balance between challenge and competence. The game does not ask the same thing of everyone, but asks of each person something that is possible and, at the same time, slightly beyond. It is in this space that the desire to continue playing and learning finds nourishment.

Around the game, finally, communities, shared narratives, and practices of reflection and cultural production develop. The videogame does not end with the play session: it continues in forums, videos, discussions, and user-created modifications. Learning extends beyond the device and becomes social, distributed, participatory. Designed play thus shows its capacity to generate ecosystems of meaning, not only isolated experiences.

In this framework, the videogame appears as a paradigmatic form of contemporary play: profoundly artificial, yet capable of producing authentic experiences; rigorously designed, yet open to the unexpected; reproducible, but never identical to itself. Its educational strength does not reside in the content it transmits, but in the type of experience it makes possible.

This reflection, however, does not end with the videogame. Other educational media from simulations to interactive laboratories, from virtual worlds to immersive narrative media share some of these characteristics and raise similar questions. What the videogame makes particularly visible is a broader transformation: the emergence of learning environments designed as experiences, in which knowledge is not only communicated, but lived. It is in this horizon that play, in its multiple forms, continues to offer contemporary pedagogy one of its most fertile fields of experimentation.

If designed play represents one of the most mature forms of intentional educational experience, scientific research has had and continues to have a decisive role in legitimising its use, testing its limits, and clarifying the conditions of its effectiveness. From the earliest experiments onward, what unites the most significant research is not the search for a 'winning formula', but the acceptance of play as an experimental environment in which learning emerges from the interaction among subject, system, and context.

One of the most influential strands is that of game-based learning, which developed between the late 1990s and the early 2000s. Squire (2013) provides a panoramic account of this development, characterising video game-based learning as an emerging paradigm for instruction and tracing its conceptual foundations from situated cognition and experiential learning to contemporary research on digital literacy and transmedia engagement. Empirical research with young populations confirms the breadth of these effects: Evans et al. (2013) investigated youth engagement with video games and found evidence of positive effects on both learning outcomes and

motivational engagement, with game characteristics related to challenge, agency, and feedback identified as the principal drivers of educational benefit. Gee (2003) has shown that many commercial videogames incorporate sophisticated learning principles: gradual progression, immediate feedback, situated learning, and the possibility of failing without sanction. These studies do not limit themselves to measuring the effectiveness of games as teaching tools, but analyse their structure as a distributed cognitive system. The value of play does not lie in explicit content, but in the way it compels the player to think, decide, and reflect on their own actions.

Another relevant field of research is that of serious games and simulations. In contexts such as medical, military, or managerial training, numerous studies have shown how simulated environments make it possible to develop complex competencies decisional, relational, ethical that are difficult to train through traditional methods. Here experimentation is central: the game becomes a safe laboratory in which high-risk scenarios can be explored without real consequences. Research highlights how the effectiveness of these environments does not depend on their 'realism', but on the coherence of the rule system and the quality of feedback.

More recent strand concerns research on adaptivity and personalisation. Within the domain of serious games for science education, immersion has emerged as a particularly studied variable: Cheng, She, and Annetta (2015) found that game immersion experience has a hierarchical structure and differentially impacts science learning at different levels of depth, while a subsequent study by Cheng et al. (2017) qualified these findings, showing that immersion is not uniformly beneficial and that its value depends critically on how it is aligned with the specific learning objectives of the game. Solenthaler et al. (2018) offer a decade-long perspective on intelligent educational games for learning spelling and mathematics, documenting both the progress made and the persistent challenges of building adaptive systems that respond meaningfully to individual learner trajectories rather than simply tracking performance metrics. Game-based learning engagement itself has received systematic theoretical and empirical attention: Ke, Xie, and Xie (2016) combined theory-driven and data-driven approaches to map the multidimensional structure of engagement in educational games, identifying cognitive, affective, and behavioural components that interact dynamically during play. Alongside digital approaches, board games represent a persistent and often underexplored medium: Bayeck (2020) offers a multidisciplinary review of research on board gameplay and learning. Within multiplayer digital environments, the role of self-explanation as a learning mechanism has received specific attention: Hsu, Tsai, and Wang (2016) found that integrating self-explanation prompts into a multiuser game significantly

improved the acquisition of scientific concepts, with the combination of collaborative play and metacognitive reflection producing gains that neither element achieved alone. A complementary analysis of the group dynamics at work in such settings is offered by Bluemink et al. (2010). Pearce et al. (2009) provide rich ethnographic evidence for the social depth of multiplayer game communities: their study of emergent cultures in online and virtual world environments shows that players construct complex social structures, shared norms, identity practices, and collective knowledge systems that go far beyond what any single game's design explicitly prescribes. For educational designers, this finding has an important implication: the social and cultural dynamics of multiplayer environments are not merely contextual noise but generative learning resources that can be deliberately cultivated. At the design level, Zea et al. (2009) advance a collaborative learning-centred vision of educational multiplayer videogames, arguing that the design must go beyond technical multiplayer functionality and deliberately engineer interdependence, shared goals, and structured communication if collaboration is to produce real cognitive gains rather than merely simultaneous parallel play., whose group-level study of multiplayer game collaboration found that individual participants actively shape the collective interaction in non-trivial ways, a finding that underscores the importance of attending to within-group heterogeneity when designing collaborative game-based learning activities. At the interactional level, Rogerson, Gibbs, and Smith (2018) have documented what they term the mutuality of cooperation and competition in boardgame play: players routinely cooperate to maintain the social fabric of the game even while competing for individual advantage, a dynamic that has direct implications for how competitive game structures can be designed to sustain rather than erode prosocial behaviour., documenting its particular strengths in developing social cognition, strategic reasoning, and collaborative problem-solving. Studies in educational data mining and learning analytics show how the systematic collection of data on players' actions makes it possible to analyse learning processes in real time. Play thus becomes not only an educational tool, but also a tool of scientific observation: an environment in which behaviour, strategies, and difficulties emerge in traceable form.

It is in this context that artificial intelligence and machine learning technologies open radically new possibilities. Yet this expansion of capability brings with it a structural tension that Ontañón and Zhu (2021) term the personalisation paradox: the more precisely a system models an individual user in order to personalise their experience, the more it risks constraining the freedom and unpredictability that make the experience really educational. Resolving this paradox, building adaptive systems that personalise without prescribing,

remains one of the central design challenges of AI-augmented game-based learning. AI makes it possible to design games capable of dynamically adapting to the player, not only by regulating the level of difficulty, but by modifying scenarios, narratives, feedback, and learning paths on the basis of observed behaviours. The game ceases to be a static system and becomes a reactive environment, capable in turn of learning.

From the standpoint of research, this means being able to experiment with highly personalised forms of learning without renouncing reproducibility. Educational intentionality remains inscribed in the design of the system, while the concrete experience is modulated by the interaction between player and algorithm. It is no longer only content or rules that are designed, but dynamic relations between system and subject.

The possible applications are multiple. In education, AI-supported games can accompany individualised learning pathways, identifying cognitive styles, strengths, and difficulties without resorting to explicit tests. In training and professional contexts, intelligent simulations can adapt complex scenarios negotiation, leadership, crisis management to the choices of the participant, offering qualitative and not merely quantitative feedback. In clinical and rehabilitative contexts, adaptive games can support therapeutic pathways, continuously calibrating cognitive and emotional effort.

Pedagogical research is also transformed by this. The use of AI in games makes it possible to observe not only whether learning occurs, but how it occurs: which strategies emerge, how they change over time, and which conditions favour engagement or abandonment. Play thus becomes a privileged space of scientific experimentation, in which education is not reduced to a dependent variable, but observed as a complex process.

Looking ahead, these technological possibilities reinforce a thesis that has already emerged: the value of educational play does not lie in the promise of simple solutions. At the leading edge of this development, Kanervisto et al. (2025) report in Nature the construction of World and Human Action Models capable of supporting gameplay ideation, AI systems that model human decision-making within game environments and generate plausible action sequences, opening the possibility of systems that can both learn from players and adaptively shape the experiences they encounter. Van Eck (2010) situates these developments within a broader cognitive framework, arguing that the learning sciences provide the conceptual tools needed to understand when and how games support cognition, and that the most productive research agenda combines theoretical rigour with attention to the specific affordances of particular game genres and designs. but in its capacity to sustain controlled yet open experiments, designed yet not rigidly prescriptive. AI and machine learning do not replace

educational design, but amplify its reach, making possible a design that accepts difference, uncertainty, and a plurality of outcomes.

In this sense, play, especially in its digital and intelligent form, continues to represent one of the most fertile terrains for educational research capable of combining scientific rigor and experiential openness. Not a model to be applied, but an environment to be explored.

3.3 The Contemporary Scenario of Game-Oriented Learning

Game-oriented learning does not arise in a theoretical vacuum, nor as a contingent response to pedagogical fashions. Rather, it is situated within a profoundly transformed horizon, in which technological innovations, cultural shifts, economic tensions, and new individual expectations converge. Understanding this scenario is a necessary condition for evaluating the meaning and potential of play as an educational device.

First of all, learning processes themselves are undergoing a radical transformation. The idea of knowledge transmitted in a linear, stable, and cumulative way is in crisis in the face of contexts characterised by the rapid obsolescence of skills and an almost unlimited availability of information. In this framework, learning no longer means merely acquiring content, but developing the capacity to orient oneself, select, interpret, and rework knowledge autonomously. Play experiences, with their exploratory and situated structure, respond to this need because they train thought in action, not mere memorisation. Couch, Towne, and Wozniak (2018) argue that technology's most transformative educational potential lies not in automating existing instructional processes but in personalising learning at scale, enabling every student to progress at the pace and in the mode that best suits their cognitive profile. Game-based and simulation-based learning environments are, in this framework, among the most powerful tools available, precisely because they combine personalisation, active engagement, and immediate feedback in a single integrated experience. Trinh (2022), writing in Nature, reports that gamifying instruction in notoriously difficult subjects produces measurable gains in student engagement and comprehension, with participants attributing their improved performance not to reduced difficulty but to transformed motivation, a finding that illustrates the practical value of game-based approaches precisely where conventional instruction struggles most. The value of such situated engagement has been documented in field-based contexts: Chen, Liu and Hwang (2016) found that the combination of game mechanics with multistage guidance strategies significantly improved both performance and motivation in mobile learning

environments. Augmented reality represents a further frontier for situated game-based learning: Dunleavy (2014) has identified the design principles specific to AR learning environments, including narrative immersion, physical engagement, and the blending of virtual information with real-world spaces, that distinguish them from both screen-based games and conventional field instruction, opening new possibilities for contexts where learning benefits from direct engagement with physical environments., suggesting that well-scaffolded game-based experiences can extend effective learning beyond the classroom.

New generations bring with them expectations deeply different from those of the past. Davidson (2017) frames the same challenge from an institutional perspective: universities, she argues, must be fundamentally redesigned to prepare students for a world of rapid change, cultivating adaptability, collaborative problem-solving, and the capacity for continuous self-directed learning rather than the passive accumulation of certified knowledge. Aoun (2017) characterises this shift in terms that are directly relevant to game-based learning: in an age of artificial intelligence, the most valuable educational outcomes are those that develop humanics, the distinctively human capacities for systems thinking, entrepreneurship, cultural agility, and creative problem-solving, that machines cannot replicate. Game-based simulations, which demand precisely these capacities rather than the retrieval of stored information, are in this sense aligned with the deepest educational challenges of the present moment. Having grown up in interactive digital environments, accustomed to reactive and personalised systems, they struggle to recognise value in educational experiences that do not provide engagement, agency, and the possibility of choice. Turkle (2011) traces a deeper consequence of this condition: as technology increasingly mediates social interaction and self-presentation, young people develop an expectation of continuous responsiveness from the environments they inhabit, an expectation that static educational formats are structurally unable to meet, and that well-designed game-based learning is uniquely positioned to address. This does not imply a reduced attention span or a rejection of complexity, but a different demand for meaning: what cannot be experienced, negotiated, and traversed struggles to be recognised as significant. Play intercepts these expectations not because it simplifies content, but because it renders learning a participatory experience.

At the same time, education is called to confront a growing tension between new and old contents. On the one hand, forms of knowledge related to technologies, data, artificial intelligence, and the complexity of systems emerge; on the other, the great cultural, historical, scientific, and humanistic contents that have structured critical thought over time remain central. The challenge is not to

choose between tradition and innovation, but to find devices capable of putting them in dialogue. Play, as a designed experience, makes it possible to reinterpret 'old' contents in new contexts, rendering them once again open to questioning.

A further decisive factor is the need to develop critical sense and the capacity to interpret contexts of increasing ambiguity. Contemporary decisions personal, professional, civic take place ever more often under conditions of uncertainty, incomplete information, and conflict of values. Learning can no longer limit itself to providing correct answers, but must train the formulation of pertinent questions, the evaluation of alternatives, and the management of ambiguity. Play experiences, especially those based on simulation and open scenarios, make it possible to exercise these competences in protected but cognitively complex environments.

New computational and forecasting techniques, including those based on artificial intelligence and machine learning, further redefine the scenario. On the one hand, they offer powerful tools for analysing data, anticipating scenarios, and personalising learning paths; on the other, they make evident the need to understand the limits, opacities, and ethical implications of such systems. Play can become a privileged space for critically exploring these technologies, not only as tools, but as objects of reflection.

Finally, this scenario is situated in a context of multilateral values and globalised culture, inserted into an economy that, paradoxically, tends to regionalise itself. People are exposed to a plurality of values, narratives, and worldviews, often in tension with one another. Learning must therefore prepare not for adherence to a single model, but for coexistence with difference, the negotiation of meanings, and the understanding of local contexts within global dynamics. Play, thanks to its capacity to stage different perspectives and simulate complex systems, offers a language suited to exploring this plurality without reducing it.

In this intertwining of technological, cultural, generational, and economic factors, learning oriented toward play experiences emerges not as a definitive solution, but as a device capable of holding together complexity and accessibility. Play does not promise certainties, but training; it does not transmit answers, but constructs contexts in which answers may be sought. It is in this capacity to offer intentionally designed experiences, yet open to interpretation and desire, that play today finds its deepest legitimation.

3.4 A First Framework for Videogames and Artificial Intelligence

Videogames and artificial intelligence can be understood within the same theoretical framework if they are considered not as tools, but as designed environments of experience. Both operate through systems of rules, computational models, and feedback that transform the user's action into situated learning. In this perspective, educational value does not reside in the content transmitted, but in the structure of interaction that makes the experience possible.

At the centre of this framework is the concept of the intentional design of open contexts. The videogame embodies this logic by rendering the rules of the system visible and allowing the player to explore them through action. AI, particularly in its machine learning applications, extends this possibility by introducing systems that not only react, but adapt. Learning is no longer only that of the user, but also that of the system, giving rise to a dynamic relation in which experience and design co-evolve.

A second theoretical pillar is non-homogenising reproducibility. Videogames and AI make it possible to design experiences replicable at scale without producing identical outcomes. What is reproduced is the type of learning exploration, decision, interpretation, reflection not the final result. The structure remains stable, while the experience differentiates itself according to the choices, competencies, and context of the subject. This distinction makes it possible to combine scalability and personalisation, two central requirements in contemporary education.

A third element is the centrality of action and feedback. In the videogame, every action generates an immediate and interpretable response from the system; in AI, this feedback can become progressively more refined, adapting to observed behaviours. Learning thus emerges as an iterative process: attempt, error, adjustment. This dynamic makes deep learning possible because it binds knowledge to lived experience and not to mere exposure to information.

The theoretical framework also includes a new conception of the time of learning. Videogames and AI break traditional didactic linearity, introducing flexible, cyclical, and personalised times. Time is no longer imposed by the curriculum, but shaped by the interaction between subject and system. This makes learning more adherent to individual needs and better able to sustain motivation over the long term.

Finally, videogames and AI share an ethical and cultural dimension. Both shape behaviours, values, and ways of interpreting the world. To place them within an educational framework means recognising their formative power and assuming responsibility for their design. Play and artificial intelligence are not neutral: they

direct attention, reward certain actions, render some paths visible and obscure others. Educational design must therefore make these mechanisms transparent and open to questioning.

In sum, videogames and artificial intelligence meet within a theoretical framework that may be defined as a pedagogy of designed experience: an approach in which learning emerges from the intentionally designed interaction between subject and system, in contexts that are replicable yet open, adaptive yet not deterministic. It is in this space that digital play and AI find a common legitimation as educational devices of the present and the future.

3.5 Winner and Loser

When we think about games, we often default to a very narrow image: one winner, everyone else defeated. Competition appears to offer the most intuitive grammar of play. A game, in this common view, is a contest that produces a victor, and the function of the players is to strive toward that singular end. Yet this assumption obscures one of the most revealing aspects of games: they organise outcomes in many different ways. Not all games crown a single champion. Some identify a single loser. Some divide players into groups of winners and losers. Some require that all players win or fail together. Others suspend the distinction altogether.

This is not a minor observation. The way a game distributes victory and defeat shapes the experience of participation, the emotional texture of the activity, the meaning of error, and the type of learning that becomes possible within it. If we want to understand the educational value of games, especially for adult learners, we must begin by recognising that 'game' is not one fixed structure. It is a family of structures, each of which organises effort, risk, cooperation, and achievement differently.

A useful place to begin is with a counterintuitive example: *Jenga*. *Jenga* does not fit neatly into the model of one winner triumphing over a field of losers. Strictly speaking, the game is organised around a different logic: one player loses, and everyone else wins. The tower stands for as long as the collective sequence of actions sustains it. Tension accumulates with every move, not because one player is visibly dominating the others, but because the whole structure grows increasingly unstable. The decisive moment comes when one player causes the tower to collapse. That player loses. The others, by implication, survive the failure and therefore win.

This configuration matters because it reverses the usual narrative of success. The centre of the game is not the glorious ascent of a champion but the avoidance of a final, irreparable mistake. In *Jenga*, the drama lies in sustaining equilibrium under pressure. The key

skill is not conquest but care, judgment, and the management of risk. That is already enough to show that games are not reducible to simple domination structures. They may be organised around collapse rather than triumph, fragility rather than accumulation, survival rather than conquest.

By contrast, the most familiar competitive format is the classical one winner, all others lose structure. Here the game is explicitly designed to produce a single victorious outcome. Many board games, sports competitions, quiz formats, and strategy games operate in this way. Whether in Monopoly, Risk, or a tournament race, the logic is clear: only one participant can occupy the final winning position. Such games heighten comparison, focus attention on performance differentials, and reward the accumulation of advantage over time. Their appeal lies partly in their clarity. The outcome is easy to interpret, and the hierarchy it creates is immediate.

This structure can be exhilarating because it sharpens motivation and makes progress legible. But it also comes with a cost. It concentrates value in one endpoint and often renders all other outcomes deficient. In educational environments, especially with adults, this can be productive in some circumstances but counterproductive in others. A single-winner structure can intensify effort, but it can also increase fear of failure, reduce willingness to experiment, and amplify the symbolic weight of losing. The pedagogical question is therefore not whether such games are good or bad in themselves, but what kind of behaviour they solicit and what emotional economy they create.

An even purer version of competitive symmetry appears in two-player, zero-sum games: one wins, one loses. Chess is perhaps the clearest example. So too are many racquet sports, duels, and head-to-head strategic games. In these cases, the relationship between gain and loss is direct and transparent. One player's progress is inseparable from the other's setback. This form is especially powerful for developing strategic adaptation, anticipation, and close attention to an opponent's intentions. It produces a highly concentrated experience of reciprocal challenge. It also makes learning visibly cyclical: one learns not only from one's own errors, but from the pressure exerted by the other player's intelligence.

And yet even here, the simplicity of the structure should not mislead us. A two-player competitive game is not merely a mechanism for separating the strong from the weak. It is also a system in which each player's competence gives shape to the other's learning. A novice opponent produces one kind of game; a sophisticated opponent produces another. Thus the educational value of such games lies not only in the outcome, but in the quality of the encounter. Competition, in this sense, is also a form of mutual structuring.

Beyond these classical cases, games often produce multiple winners and multiple losers. This occurs in team games, qualifying formats, threshold-based systems, and many multistage competitions. In football, basketball, or volleyball, for example, one team wins and another loses. Here victory and defeat are distributed collectively rather than individually. The result no longer belongs to a single person, even though individual contributions remain important. This changes the meaning of play profoundly. Responsibility is shared. Coordination matters. Individual excellence must be integrated into collective rhythm. One can perform brilliantly and still lose; one can make mistakes and still be carried by the group. The game teaches not only execution, but interdependence.

There are also games in which some individuals succeed while others fail without the field collapsing into a single winner. In elimination rounds, qualification systems, or games with multiple success thresholds, the outcome is pluralised. Several players may 'make it', while others do not. This is particularly important if one wants to move beyond the idea that games always produce a single apex position. Some games recognise differentiated success. They sort participants into groups rather than into an absolute hierarchy. This can be pedagogically useful because it permits competition without making recognition infinitely scarce.

A very different structure emerges in fully cooperative games, where all players win together or all players lose together. In such games, the real opponent is not another player but the system itself: the spreading disease in Pandemic, the puzzle in an escape room, the constraints of time, the limits imposed by rules or scenario. Here the game becomes a rehearsal for coordination under shared pressure. The meaning of error changes dramatically. A mistake is not simply one person's failure but part of a collective problem-solving process. Success depends on communication, role differentiation, timing, trust, and the capacity to read a situation from multiple perspectives.

This form has obvious relevance for learning. It lowers the symbolic penalty attached to individual failure and shifts attention from rank to contribution. It encourages participants to see intelligence as distributed across the group rather than concentrated in a single performer. Especially in adult education, where many learners carry anxieties related to judgment, competence, and exposure, cooperative structures can create psychologically safer ways to engage with challenge. They do not eliminate difficulty. On the contrary, they often make difficulty more complex. But they reframe it as a shared task rather than as a public test of individual worth.

There are also games in which nobody exactly wins, but one or more players lose. These are often penalty-based or elimination-centred experiences, where the main tension lies in avoiding error rather than achieving a triumphant endpoint. Such games can be socially intense

and highly engaging, but they also reveal that not all game structures are organised around positive victory conditions. Some are organised negatively, around exclusion, collapse, or survival. Their emotional centre is caution, suspense, and the management of vulnerability.

At the other end of the spectrum are games in which multiple players may succeed in different ways, or in which the distinction between winning and losing becomes secondary. Narrative role-playing games, sandbox environments, creative simulation spaces, and many forms of open-ended play do not always culminate in a singular result that can be neatly scored. Their value lies in exploration, expression, improvisation, construction, and interpretation. Here the game is less a machine for ranking participants than a space for generating experience. One might say that the 'outcome' of such play is not victory but transformation: a new understanding of the system, a new story, a new possibility, a new configuration of meaning.

This matters enormously for any serious theory of play and learning. If we reduce games to the one-winner model, we miss their broader cultural and educational significance. Games can train direct competition, but they can also cultivate restraint, resilience, cooperation, experimentation, shared problem solving, and creative participation. The educational question is therefore not simply whether games motivate learners. It is what kind of relational structure a given game creates, and what kind of learner that structure calls into being.

A single-winner game invites one kind of subject: ambitious, comparative, outcome-oriented. A one-loser game invites another: careful, self-monitoring, attentive to thresholds of collapse. A cooperative game invites yet another: relational, communicative, strategically collaborative. Open-ended play invites still another: exploratory, imaginative, intrinsically motivated. Each of these forms generates different patterns of attention, different attitudes toward error, different experiences of success, and different modes of participation.

For this reason, any attempt to connect play and learning must avoid speaking of 'the game' in the singular, as though all games carried the same pedagogical logic. They do not. The way victory and defeat are distributed is not a superficial detail. It is one of the deepest organising principles of a game, and one of the clearest indicators of what that game can teach. If we take this seriously, then play becomes far more than a motivational device. It becomes a repertoire of structures through which different forms of learning can be designed, enacted, and experienced.

And perhaps this is the most important conclusion. Games do not merely entertain different people in different ways. They model different worlds. Some worlds reward solitary superiority. Some punish error. Some make success collective. Some multiply possible

achievements. Some suspend victory altogether in favour of discovery. To think seriously about games is therefore to think seriously about the architectures of participation we place before learners. And to think seriously about learning is to ask not only what knowledge is transmitted, but under what conditions people are invited to act, to risk, to fail, to persist, and to succeed.

3.6 Motivational and Behavioural Variables

The motivational force of a game is never produced by rules alone, nor by theme alone, nor even by the skill of the players. It arises, more fundamentally, from the way the game distributes outcomes: who may win, who may lose, whether success is exclusive or shared, whether failure is individualised or collective, and whether victory is defined at all. These structures are not merely formal devices. They shape the affective and cognitive conditions of participation. They determine what players attend to, how they interpret risk, how they relate to one another, and what kind of effort they are prepared to sustain. In this sense, every game contains an implicit model of motivation.

The model in which one wins and all others lose is perhaps the clearest expression of agonistic play. Its defining feature is the scarcity of recognition: only one player may occupy the position of success, and the value of that success is intensified precisely because it is denied to everyone else. Such a structure generates a strong motivational economy of comparison. Players are driven not simply to perform well, but to prevail over others. What is cultivated here is not only ambition, but a particular disposition toward rivalry, measurement, and differentiation. The player learns to read advantage relationally, to treat progress as positional, and to interpret achievement as meaningful insofar as it exceeds the performance of others. This model is therefore especially effective in training competition and confrontation. It can heighten concentration, sharpen strategic awareness, and intensify commitment. At the same time, because it binds recognition to a singular outcome, it may also amplify the symbolic weight of failure. Motivation becomes inseparable from exposure: the desire to win is coupled with the risk of being publicly defeated.

A rather different motivational structure emerges in games where one player loses and all others win. At first sight, this may seem like a minor variation on competitive play; in fact, it produces a distinct experiential logic. Here the central dramatic event is not the triumphant ascent of a winner but the collapse produced by a loser. The game's energy is organised around the avoidance of a terminal mistake. As a result, motivation shifts away from expansion and toward maintenance, vigilance, and control. Players are not driven primarily by the desire to dominate, but by the need to remain composed

under increasing pressure. Such games foreground attention and endurance. They reward steadiness, calibration, timing, and the capacity to sustain performance in conditions of growing fragility. The pleasure they offer is therefore not mainly the exhilaration of superiority, but the tension of continued survival within an unstable system. From the standpoint of learning, this structure is especially significant because it places value on persistence and self-regulation. It teaches that the decisive challenge is not always to surpass others, but sometimes to remain attentive enough not to become the point at which the system fails.

The model in which all players win together, or all players lose together alters the motivational field more radically still. Here the game ceases to be a site of direct opposition among participants and becomes, instead, a structured encounter with a common challenge. The obstacle may take the form of time, complexity, uncertainty, a hostile scenario, or the internal logic of the system itself; but in every case, the relevant fact is that success is shared and failure is shared. This configuration redistributes motivation from comparison to interdependence. Players are encouraged to coordinate rather than outmanoeuvre, to communicate rather than conceal, to recognise complementary capacities rather than seek singular distinction. What such games strengthen is not merely cooperation in the superficial sense of working alongside others, but a more demanding form of collective intelligence: the capacity of a group to think, decide, adapt, and solve problems in ways that exceed the resources of any one member taken alone. The motivational power of this structure lies in contribution rather than domination. One remains engaged because one's action matters to the whole, and because the whole, in turn, makes individual action meaningful. Particularly in educational contexts, this model has considerable importance, since it lowers the punitive force of individual error while preserving challenge, and thereby creates conditions more favourable to trust, distributed reasoning, and sustained participation.

Finally, there are game forms in which no definitive winner is established, and in which the traditional opposition between victory and defeat recedes or disappears altogether. In these cases, the game is not primarily organised as a contest but as a space of exploration, experimentation, narration, construction, or discovery. Its motivational structure is therefore less extrinsically oriented toward a terminal outcome and more intrinsically tied to the generativity of the activity itself. What such games favour is exploration and creativity, precisely because they loosen the pressure of evaluative closure. When players are not compelled to direct all effort toward the capture of a final winning position, they are often more willing to improvise, to test unconventional possibilities, to remain in uncertainty, and to pursue curiosity as a legitimate mode of engagement. The absence of

a defined victor does not weaken motivation; rather, it reconfigures it. Engagement is sustained not by rivalry or survival, but by the unfolding richness of the possibility space. This is especially important for any theory of learning that seeks to value invention as much as mastery. In such environments, creativity is not an ornamental supplement to performance; it becomes the principal form through which participation acquires meaning.

Taken together, these different configurations show that games do not motivate through a single universal mechanism. They produce distinct motivational regimes. A single-winner game calls forth ambition, comparison, and strategic opposition. A single-loser game cultivates vigilance, restraint, and resilience under pressure. A fully cooperative game mobilises mutual reliance, communication, and collective problem-solving. An open-ended game invites curiosity, improvisation, and imaginative experimentation. Each structure forms a different relation between the player and the possibility of success; each distributes risk and recognition differently; each teaches, implicitly, a different way of inhabiting challenge. For this reason, any serious engagement with play especially in relation to learning must resist the temptation to speak of games as though they constituted a homogeneous category. What matters is not simply that a learning experience is 'game-based', but what kind of game it resembles, what kind of motivation it elicits, and what kind of subject it asks the participant to become.

3.7 Cooperative and Competitive Structures in Educational Design

Suppose you enter a classroom. Or rather, suppose you enter what appears to be a classroom but which, on closer inspection, reveals itself to be something more ambiguous a space in which the boundaries between play and instruction have been deliberately, perhaps mischievously, dissolved. You will need, before proceeding, to make a distinction. There are two kinds of dissolution and confusing them leads to error.

The first kind is the *serious game*: a complete world, self-enclosed, governed by its own internal logic, designed not for pleasure alone but for the transformation of whoever inhabits it. The second kind *is gamification:* not a world but a dressing, a set of signals points, badges, levels, leaderboards applied to an environment that remains, underneath its new costume, an environment of instruction. Both produce effects. Both alter the learner. But they do so as two different cities alter the traveller who passes through them: one by immersing, the other by orienting.

The question of which produces the greater effect is, like most questions of this kind, answerable and yet unsatisfying in its answer. Nebel, Schneider, and Rey (2016) examined social competition and learning across different group sizes in educational videogames, finding that competition effects on learning are moderated by group size in ways that challenge simple predictions: individual competition against a single opponent produces different cognitive and motivational dynamics than competition within larger groups, with implications for how competitive structures should be calibrated to instructional goals. Meta-analytic evidence awards the stronger aggregate effect on achievement and motivation to gamification, understood, in Deterding et al.'s (2011) foundational definition, as the use of game design elements in non-game contexts. Kim et al. (2018) provide an extensive review of gamification applications in learning and education. Kapp, Blair, and Mesch (2014) offer a practitioner-oriented complement, translating gamification research into concrete design tools and techniques for learning professionals: their field book documents how elements such as points, badges, leaderboards, narrative, and challenge levels can be systematically combined to produce motivationally rich instructional environments, while emphasising that gamification is most effective when it builds on real learning goals rather than decorating content with superficial game mechanics. At the level of individual elements, Landers, Bauer, and Callan (2017) conducted a goal-setting experiment specifically on leaderboards, finding that the effect of leaderboard feedback on task performance depends critically on the nature of the goal it is paired with: leaderboards enhance performance when paired with learning goals but can inhibit it when paired with purely performance-focused goals, a nuance that should inform any deployment of competitive ranking in an educational context. The scientific foundations of this field are traced by Landers et al. (2018), who provide a historical and prospective account of gamification science, arguing that the field requires more rigorous experimental design and clearer theoretical grounding if its claims about motivational and learning effects are to be distinguished from the artefacts of poorly controlled studies., documenting both its motivational power and the conditions under which its effects erode when extrinsic rewards crowd out intrinsic engagement. Yet the serious game, quieter in its claims, demonstrates a more persistent intimacy with something the numbers call intrinsic motivation the kind of engagement that does not require a scoreboard to justify itself. To understand why, one must be willing to think about desire.

There are, the psychologists tell us, two varieties of desire in learning. One looks outward: it wants the reward, the recognition, the visible proof of advancement. The other looks inward: it wants the thing itself the problem solved, the idea understood, the experience

completed. Gamification speaks fluently to the first. Serious games, by the nature of their architecture, tend to cultivate the second. This is not a moral distinction; it is a structural one. A city of mirrors and a city of canals are not better or worse than each other. They simply produce different kinds of attention in those who walk through them.

To go further, one requires the vocabulary of a discipline that has spent considerable effort thinking about what happens when rational agents interact. Economics or more precisely, that subdiscipline which calls itself game theory offers a set of categories that, applied to the classroom, illuminate what might otherwise remain obscure.

Consider the competitive situation. In it, one learner's ascent is composed, at least in part, of another learner's relative descent. This is what game theory describes with the cold elegance of the phrase zero-sum: the gains and the losses balance precisely, like a perfectly maintained ledger. The leaderboard is the purest expression of this logic. It does not merely report performance; it constructs a rank, and in constructing a rank, it makes visible the very comparison that motivates the competitor. Gamification, in its more familiar forms, tends toward this architecture: the points accumulate, the rankings shift, the learner is invited to want not merely progress but position.

Serious games acknowledge competition too they may have winners and losers, victors and the defeated but their competitive dynamics are typically embedded within a larger structure that gives them meaning beyond mere rank. One competes, in a serious game, within a world that has already asked something of you: your attention, your investment, your willingness to accept its premises. The competition, when it appears, is therefore coloured differently.

Now consider the cooperative situation. Here, the learner discovers something that competitive logic conceals: that the total available to be won can be enlarged by collaboration. Game theory names this positive-sum, and the name is quietly revolutionary, because it proposes that gain need not be extracted from another's loss that it can be, under the right conditions, generated collectively. When learners work together in teams, share strategies, distribute cognitive labour, and construct understanding in common, they are participating in what is, structurally, a cooperative game. The empirical literature confirms that serious games create conditions hospitable to this form of engagement. Experimental evidence goes further: Greitemeyer (2013) found that playing video games cooperatively, as opposed to competitively or alone, significantly increased empathic concern among participants, while Greitemeyer and Cox (2013) demonstrated that cooperative gameplay produced measurable increases in cooperative behaviour in subsequent tasks. Designing videogames to exploit these social affordances for educational ends has become a recognised field of practice: González-González and Blanco-Izquierdo (2012) analyse the specific design choices, shared

goals, complementary roles, visible interdependence, that make social videogames effective for educational use, providing practical guidance for designers who wish to harness cooperative dynamics for learning. These findings suggest that the social structure of game design is not merely a contextual variable but an active shaper of participants' motivational and interpersonal orientations. Landers and Armstrong (2017) tested the Technology-Enhanced Training Effectiveness Model and found that game-based instructional designs significantly enhance learning outcomes when they are integrated with clearly defined learning objectives rather than appended as motivational overlays. It also confirms and this detail deserves emphasis that environments characterised by psychological safety, by the absence of punitive consequence for error, significantly enhance intrinsic motivation. Fear, it turns out, is not a neutral variable. It occludes the very curiosity it is sometimes invoked to sharpen.

Three conclusions follow from this mapping, and they have the quality of good conclusions: they illuminate what was already present in the evidence, but arrange it so that its shape becomes visible for the first time.

The first is that competitive design serves the purpose of activation. When a teacher needs to mobilise effort rapidly, to convert inertia into engagement, to make a routine task temporarily legible as a contest worth entering, competitive gamification works. It works because it constructs incentives, and incentives, as any student of economics will confirm, reliably alter behaviour. The learner who might otherwise drift is anchored, briefly, by the visible presence of a reward.

The second is that cooperative design serves the purpose of depth. When the instructional aim is understanding rather than performance when the teacher is asking the learner not merely to produce a correct answer but to inhabit a problem, to turn it over, to discover its underside then cooperative structures are the more appropriate architecture. They do not merely reward; they transform the social space of learning into something resembling what game theory calls a coordination problem: a situation in which the best outcome for each depends on finding alignment with the others.

The third conclusion is perhaps the most interesting, because it refuses the simplicity of the previous two. It proposes that the most effective learning environments are neither purely competitive nor purely cooperative, but that they hold both logics in productive tension. This is not a counsel of moderation; it is a structural observation. Competition without cooperation narrows learning into performance and excludes the learner who perceives the rank order as already settled against them. Cooperation without the friction of incentive creates conditions for what economists, with their talent for austere naming, call free-riding the tendency of some participants

to reduce their contribution when it cannot be individually observed. The classroom, like most complex systems, is a social dilemma: individuals and collectives do not automatically want the same things, and the work of pedagogical design is precisely to construct conditions under which their interests converge.

A taxonomy, at this point, becomes useful not as a cage for the ideas, but as a provisional map, the kind that one carries knowing it will require revision. Le Hénaff et al. (2015) have examined the role of social identity in team game-based learning, finding that group identification, but not anonymity alone, significantly shaped performance, with implications for how team composition and social context should be managed in cooperative game-based learning environments. At a broader civic level, Kahne, Middaugh, and Evans (2009) have documented that participation in certain types of games, particularly those involving civic scenarios, political simulation, and collective problem-solving, is associated with higher levels of civic knowledge, political engagement, and community participation among young people, suggesting that the prosocial potential of well-designed game-based learning extends beyond the classroom. Raphael et al. (2010) provide the conceptual and design framework needed to operationalise this potential: their account of games for civic learning identifies the structural features, authentic civic problems, multiple stakeholder perspectives, consequential choices, and deliberative reflection, that must be present for a game to function as a real instrument of civic education rather than mere entertainment with a civic veneer. Whitton (2011) offers theoretical grounding for this approach: her game engagement theory, developed specifically for adult learners, argues that the effectiveness of game-based learning depends on the creation of an environment that balances challenge, curiosity, control, and fantasy in ways responsive to adult motivational structures. At the level of design, Garneli, Giannakos, and Chorianopoulos (2017) have shown empirically that the combination of narrative, gameplay mechanics, and making activities produces differentiated effects on student performance and attitudes, suggesting that no single element of serious game design is sufficient on its own.

Zero-sum structures find their proper application in contests, leaderboards, and the rapid ignition of short-term effort. Positive-sum structures belong to peer instruction, collaborative inquiry, and the patient construction of conceptual understanding. Coordination structures illuminate those moments when a group of learners must align on a shared framework a common method, a shared premise, a collectively negotiated interpretation. And the logic of the social dilemma illuminates the dynamics of group work itself: the persistent possibility that the collective good and individual interest will

diverge, unless the design of the task makes cooperation the rational as well as the generous choice.

What this mapping ultimately reveals is that gamification and serious games are not two delivery mechanisms for the same content. They are two different grammars of motivation, two different ways of structuring the relationship between the learner and the act of learning. Gamification speaks the language of incentive and comparison. Serious games speak the language of immersion and meaning. Neither is sufficient alone.

The closing argument can therefore be unfolded by making explicit the steps compressed in the preceding synthesis. When we say that game-based learning improves achievement and motivation, we are saying something that sounds simpler than it is. Achievement and motivation are not a single substance that either increases or does not. They are, rather, two distinct phenomena that can be present in very different proportions and for very different reasons. A learner can achieve without being motivated driven forward by the architecture of reward and consequence, producing correct outputs the way a mechanism produces outputs, reliably and without investment. And a learner can be motivated without achieving deeply engaged with a problem, fascinated by its contours, and yet lacking the structure that converts fascination into measurable progress. The ideal, naturally, is both. But the path to both is not a single road.

This is where the distinction between activation from outside and activation from within becomes decisive not as a metaphor, but as a precise description of two different causal chains.

To activate from outside is to construct, around the learner, a set of conditions that make effort the rational response. The leaderboard says: your position is visible, and visibility implies consequence. The badge says: there is a threshold, and crossing it will be registered. The timer says: time is finite, and inattention has a cost. None of these mechanisms require the learner to care about the content. They require only that the learner care about the reward, the rank, or the avoidance of loss and this, as any honest observer of human behaviour will confirm, is a far easier condition to satisfy. Extrinsic motivation is, in this sense, democratically available: it does not wait for curiosity to arrive. It produces movement in its absence.

But movement is not the same as direction, and direction is not the same as destination. The learner who moves because of external pressure moves for as long as the pressure persists. Remove the leaderboard, and the ranking ceases to matter. Remove the badge, and the threshold becomes arbitrary. The improvement in achievement that competitive mechanics produce is real the empirical record is unambiguous on this point but it is, structurally, contingent. It depends on the continued presence of the external scaffolding that produced it. This is not a flaw unique to game-based design; it is a

general feature of extrinsically motivated behaviour, known since the earliest days of educational psychology and confirmed with stubborn consistency ever since.

To activate from within is a different matter entirely, and considerably more difficult to engineer. It requires not the construction of external pressure but the creation of internal conditions a state in which the learner's own curiosity, sense of competence, desire for understanding, or need for autonomy becomes the engine of engagement. Serious games, at their best, attempt precisely this: they build worlds coherent enough and rewarding enough in themselves that the learner's motivation becomes, gradually, a function of the world rather than of the reward for inhabiting it. The learner who is activated from within continues after the class ends. They think about the problem in the corridor. They return to it. When we say that the classroom can make learning feel like something the learner 'choose', we are not describing an illusion a pedagogical sleight of hand in which the teacher's agenda is concealed behind the appearance of autonomy. We are describing something more interesting and more demanding: the real production of autonomous motivation through carefully designed conditions. This is what the psychological literature on self-determination theory has argued for decades that autonomy is not simply given or withheld, but that it can be cultivated, that environments can be designed in ways that make the learner's own will the proximate cause of their engagement.

The hybrid design that this chapter advocates accomplishes this in two stages competitive and cooperative ones.

Competitive mechanics generate the initial movement. This is the first stage, and it is, frankly, the less elegant of the two but it is indispensable. The learner who has not yet been activated cannot choose to engage; they are, in the relevant sense, not yet present as a learner. Competitive mechanics solve this problem by making engagement the path of least resistance. They lower the activation energy of effort. They do not ask the learner to care about the content; they ask only that the learner respond to incentive, which is a far more modest and reliable request. The movement they generate is preliminary a first step that does not yet know where it is going.

Cooperative structures sustain it**.** This is the second stage, and it is where the transformation occurs. Once the learner is moving, the question becomes whether the environment can convert that movement into something with its own internal momentum something that continues not because the pressure is maintained but because the learner has, in the course of moving, discovered a reason to continue. Cooperative structures create the conditions for this conversion. They place the learner in relation to others in ways that produce real interdependence: I need your understanding to advance my own, and you need mine. This interdependence is not

merely social; it is cognitive. Explaining something to another person clarifies it. Encountering another's confusion illuminates one's own unexamined assumptions. The cooperative structure, in other words, makes the learning itself the reward gradually, imperfectly, but real.

And it is in this gradual, imperfect process that the learner arrives at the experience of having chosen. Not because no one designed the environment someone did, with considerable care but because the design has, at its best, worked itself invisible. The scaffolding has been removed, or rather, the learner has grown tall enough that they no longer notice it. What remains is the problem, the understanding, and the learner who has, somewhere in the architecture of a well-designed classroom, become the kind of person who finds that particular combination sufficient. This is not a small achievement. It is, in fact, the central ambition of education restated here, as so many central ambitions eventually are, in the language of the age.