International Journal of Social and Humanities Sciences Research
JSHSR
Uluslararası Sosyal ve Beşeri Bilimler Araştırma Dergisi
Uluslararası Hakemli Dergi- International Refereed Journal
ISSN: 2459-1149

Received-Makale Geliş Tarihi 02.05.2026
Published-Yayınlanma Tarihi 30.06.2026
Volume-Cilt (Issue-Sayı), ss/pp 13 (132),1103-1119

Research Article / Araştırma Makalesi
10.5281/zenodo.21150722

Assoc. Prof. Semih Göksel Yıldırım, PhD.
https://orcid.org/0000-0002-7832-6575
İstanbul Gelisim University, Faculty of Engineering and Architecture, İstanbul / TÜRKİYE
ROR Id: 0188hvh39

The Render Trap: Pedagogical Challenges and Tectonic Integrity in Architectural Education via a Multi-Scalar Technical Audit

Render Tuzağı: Çok Ölçekli Teknik Denetim Aracılığıyla Mimarlık Eğitiminde Pedagojik Zorluklar ve Tektonik Bütünlük

ABSTRACT

Digital modeling and visualization have transformed architectural education, positioning representation as a dominant force that is often inseparable from the design process. However, the rise of high-end rendering and Generative AI (GenAI) has created a critical tension between visual persuasion and tectonic reality, leading to a phenomenon defined here as the "Render Trap." Addressing the absence of standardized metrics to quantify this disconnect, this study introduces the Tectonic Integrity Scale (TIS), a novel evaluative instrument developed to measure the alignment between architectural imagery and constructive logic. The research utilizes a multi-scalar Technical Audit methodology to evaluate 37 senior-level projects from a high-fidelity design laboratory, verifying structural alignment across three distinct tiers from 1:500 urban massing to 1:20 construction details. To maximize baseline internal consistency and eliminate traditional jury noise during this initial validation phase, the audit was executed through a highly calibrated, single-auditor protocol. The findings reveal a significant pedagogical crisis: while only 24% of projects achieved the "Full Tectonic Maturity" (TIS Level 4), a substantial 76% displayed varying degrees of disjunction between visual representation and tectonic coordination. Specifically, 41% of students utilized a "Visual Shield" to mask structural inconsistencies within the "Illusion Trap," and 35% reached "Representational Collapse" (TIS Level 1), exposing an "Ontological Void" devoid of physical assembly logic. Concluding this initial validation, the study outlines a methodological blueprint to upscale this baseline into a comprehensive longitudinal matrix, deploying a multi-evaluator, "Independent Evaluator Framework" quantified via Fleiss' Kappa and Intraclass Correlation Coefficient (ICC) metrics. Ultimately, this initial diagnostic application of the TIS framework provides a robust pedagogical bridge to ensure that architectural maturity in the GenAI era is measured by the rigorous verification of tectonic integrity rather than the seductive power of the digital illusion.
Keywords: Tectonic Integrity Scale (TIS); The Render Trap; Generative AI (GenAI); Visual Literacy; Design Studio Pedagogy; Constructive Logic.

ÖZET

Dijital modelleme ve görselleştirme teknolojileri, temsili tasarım sürecinin ayrılmaz ve baskın bir gücü haline getirerek mimarlık eğitimini kökten dönüştürmüştür. Ancak, ileri düzey render araçlarının ve Üretken Yapay Zekanın (GenAI) yükselişi, görsel ikna edicilik ile tektonik gerçeklik arasında kritik bir gerilim yaratmış ve bu çalışmada "Render Tuzağı" olarak tanımlanan olguyu ortaya çıkarmıştır. Bu kopuşu ölçümleyecek standartlaştırılmış metriklerin eksikliğinden yola çıkan çalışma; mimari imge ile yapım mantığı arasındaki uyumu değerlendirmek üzere özgün bir ölçme aracı olarak geliştirilen Tektonik Bütünlük Ölçeği'ni (TIS) literatüre tanıtmaktadır. Araştırma kapsamında, üst düzey bir tasarım laboratuvarından alınan 37 bitirme projesi, çok ölçekli bir "Teknik Denetim" metodolojisiyle analiz edilmiş; tasarım niyetinin doğrulanması amacıyla 1:500 kentsel kütle kararlarından 1:20 sistem detaylarına uzanan üç farklı kademede yapısal tutarlılık test edilmiştir. Bu ilk doğrulama aşamasında iç tutarlılığı maksimuma çıkarmak ve geleneksel jürilerin getirdiği estetik gürültüyü elemine etmek amacıyla denetim süreci, yüksek düzeyde kalibre edilmiş, tek denetçili bir protokol aracılığıyla yürütülmüştür. Bulgular ciddi bir pedagojik krize işaret etmektedir. Analiz edilen projelerin yalnızca %24'ü "Tam Tektonik Olgunluk" (TIS Seviye 4) düzeyine ulaşabilirken, %76 gibi büyük bir çoğunluk ise görsel temsil ile tektonik koordinasyon arasında değişen derecelerde kopukluklar sergilemiştir. Spesifik olarak, öğrencilerin %41'i "İllüzyon Tuzağı" içerisindeki teknik çelişkileri gizlemek amacıyla bir "Görsel Kalkan" kullanmış; %35'i ise fiziksel bir araya geliş mantığından yoksun bir "Ontolojik Boşluk" barındıran "Temsili Çöküş" (TIS Seviye 1) aşamasına gerilemiştir. Bu ilk doğrulama aşamasını tamamlayan çalışma, elde edilen temel verileri gelecekte genişletilmiş boylamsal bir matrise dönüştürmek amacıyla; Fleiss' Kappa ve Sınıf İçi Korelasyon Katsayısı (ICC) metrikleriyle desteklenen çok değerlendiricili bir "Bağımsız Değerlendirici Modeli" yöntemsel yol haritasını ortaya koymaktadır. Sonuç olarak, TIS çerçevesinin bu ilk tanısal uygulaması (pilot uygulaması), Üretken Yapay Zeka çağında mimari olgunluğun dijital illüzyonun baştan çıkarıcı gücüyle değil, tektonik bütünlüğün titizlikle tescil edilmesiyle ölçülmesini sağlayan pedagojik bir köprü sunmaktadır.
Anahtar Kelimeler: Tektonik Bütünlük Ölçeği (TIS); Görselleştirme Tuzağı; Üretken Yapay Zeka (GenAI); Görsel Okuryazarlık; Tasarım Stüdyosu Pedagojisi; Yapım Mantığı.

1. INTRODUCTION

Digital advancements over the last three decades have reshaped architectural education, positioning visual representation as a dominant force. The transition from manual drawing to Computer-Aided Design (CAD), Building Information Modeling (BIM), and advanced rendering has fundamentally altered architectural thinking. Beyond introducing new tools, this shift reshaped tectonic practice and how structural logic is conceived (Schmidt, 2007). Digital tools now form the foundation of architectural curricula (Ceylan et al., 2024), necessitating frameworks that integrate classic tectonic elements with digital processes (Liu & Lim, 2006). Consequently, tectonics has evolved into a dynamic field where technical systems and structural components interact to define space (Akgün, Erkarslan & Kavuncuoğlu, 2022).

Contemporary design studios serve as primary environments for conception and communication rather than mere documentation. As an organizational structure, the studio strategically integrates students, instructors, and communication tools to foster creativity (Paker Kahvecioğlu, 2007), shaping a culture that balances design thinking with professional behavior (Hacihasanoglu, 2019). Furthermore, artificial intelligence (AI) functions as a 'design assistant', accelerating workflows from pre-design to construction (Sabono, 2025). This rapid AI advancement reshapes traditional workflows (Lu, 2024), offering innovative approaches to learning and creative exploration (Alymani, 2024).

Recent data indicates high AI adoption rates in architectural concept development (75%) and structural form generation (72.3%) (Khogali, 2024). However, this emphasis on visual representation (Perez-Gomez & Pelletier, 1997) introduces a critical pedagogical challenge: 'representational fluency' often detaches the image from tectonic reality. The seductiveness of high-quality rendering can create a premature sense of completion, leading students to prioritize 'visual persuasion' over 'technical coordination' (Pallasmaa, 2011). Thus, 3D visualization has evolved into a persuasive medium where the render often ceases to be a verification tool and becomes an end in itself (Sandres, 2022).

In wide-span structures, where the structural system generates form, the gap between representation and buildability measures architectural maturity. While digital tools facilitate formal experimentation, they also create a 'Visual Shield'—defined here as the use of atmospheric rendering effects to mask structural inconsistencies—concealing technical failures behind aesthetic layers. This treatment of the exterior recalls Semper's (1989) concept of "Bekleidung" (dressing), where the surface acts as a communicative mask ideally connected to constructive logic. Theoretically, while structure represents physical stability, tectonics is the art of giving visual form to technical reality (Sekler, 1965). As the art of construction, tectonics balances technical necessity with aesthetic expression (Mahmood & Al-Alwan, 2023).

A significant disconnect has emerged, creating a 'tectonic gap' between sophisticated visual outputs and underlying structural logic. High-quality renderings often act as a mask, concealing technical deficiencies such as structural instabilities and coordination failures (Sekler, 1965). This phenomenon fosters a deceptive evaluation environment where atmospheric aesthetics, rather than tectonic rigour, drive 'perceived quality'. While existing literature extensively discusses the aesthetic and creative benefits of digital tools, a distinct methodological gap exists: the absence of a standardized, cross-scalar metric to evaluate tectonic coherence. Current studies focus on software efficiency or jury psychology but rarely scrutinize the 'illusionary' nature of these tools in large-span structures. This research addresses this gap by introducing the Tectonic Integrity Scale (TIS) as a novel evaluative instrument.

The 'Digital Illusion'—a phenomenon where simulated visual fidelity lacks a direct constructive correspondence in technical documentation—is a growing global crisis in architectural education. As digital fluency dominates studios, maintaining tectonic integrity becomes paramount. Dependency on digital tools is now a fundamental curricular element (Ceylan et al. 2024), yet AI adoption complicates the traditional design dialogue (Ozorhon et al. 2025). Rapid technology integration necessitates a critical re-evaluation of educational activities (Hassanpour & Sahin, 2021). Building upon previous investigations into integrating technical knowledge (Yildirim, 2025) and the challenges of structural design education (Yildirim & Baur, 2025), the contemporary digital ecosystem—increasingly influenced by high-fidelity rendering software and emerging generative technologies—presents new layers of complexity to the representation-reality gap. Recent analyses also highlight the shifting role of the architect (Yildirim & Erol, 2025). Utilizing the ARC415 studio as an initial diagnostic laboratory, this research investigates the potential misalignments of constructive logic in the face of hyper-realistic imagery.

This study identifies an assessment gap: the lack of a framework to evaluate how digital 'persuasion' influences the grading of projects with fundamental structural flaws. By categorizing projects through the lens of 'Tectonic Integrity'—the measurable alignment between architectural form and buildable structural logic—this research exposes the 'illusion trap' where students prioritize the image over coordinated assembly. Filling this gap is essential to bridge the divide between the digital image and physical construction. The research hypothesizes that representational quality is not always positively correlated with technical proficiency; instead, it often masks tectonic inconsistencies. Specifically, hyper-realistic renderings create a 'halo effect,' leading to an overestimation of technical maturity.

In wide-span structures, students with lower technical competence often rely on 'visual atmosphere' to bypass rigorous structural coordination. Consequently, the 'Illusion Trap' group reveals that digital fluency can inadvertently hinder learning by providing a shortcut to perceived success without achieving structural truth. To address this, the study introduces a 'Technical Audit' methodology and the 'Tectonic Integrity Scale (TIS)' as a pilot framework to investigate the alignment between representation and constructive reality.

The research focuses on a sample of 37 senior-level projects from the ARC415 studio at Istanbul Gelişim University during the 2025-2026 Fall Semester. The selected typology, 'Wide-Span Sports Facilities,' represents a stage where structural logic and spatial form are inseparable. The investigation evaluates how students communicate complex systems through a cross-evaluation of technical portfolios. This evaluates the disparity between atmospheric digital persuasion and the structural integrity of the architectural solution, revealing instances of the 'Ontological Void'—the technical gap where the architectural representation exists without a viable structural or material basis.

2. METHODOLOGY & THEORETICAL FRAMEWORK

This study evaluates project outcomes within a design studio setting defined by specific pedagogical constraints. The studio comprised 37 students, a density exceeding the ideal instructor-to-student ratio for senior-level technical projects. Managing this complexity necessitates practical strategies to ensure skill acquisition without overloading the participants (Soliman, 2017). Consequently, a strategic "Open-Audit" format was adopted, replacing traditional individual desk-critiques with collective learning via digital projection. This approach fosters a studio culture of collaboration, allowing transparent interaction between instructor and students (Hacihasanoglu, 2019) while ensuring peer learning (Qureshi, 2020). Utilizing this environment as a high-fidelity laboratory, the research serves as the initial diagnostic phase for the proposed methodology.

To maintain objectivity and ensure internal consistency, the course instructor conducted all juries. As the Tectonic Integrity Scale (TIS) is a pioneering application introduced in this study, maintaining a single-expert audit was a methodological necessity during this calibration stage to eliminate variable 'noise' or subjective aesthetic biases often found in traditional multi-member juries. A two-week revision period followed the final jury, allowing students to rectify identified "tectonic gaps"—defined here as technical discrepancies between conceptual design and constructive execution. This timeline ensures that failures in the "Representational Collapse" group stem from a lack of technical depth rather than time pressure.

As previously established, the framework is grounded in 'Tectonic Integrity'. In architectural theory, tectonics transcends visual form, representing the relationship between structural necessity and the art of construction. Kenneth Frampton (1995) emphasizes that tectonics shifts architecture from a "scenographic" phenomenon to an "ontological" ground, warning against buildings becoming mere images detached from construction reality. Building on this, the study adopts Eduard Sekler's (1965) distinction: while structure is the abstract system of stability, tectonics is its expressive realization. In wide-span structures, this Integrity is essential for architectural legitimacy.

The Tectonic Integrity Scale (TIS) was systematically developed by distilling these core principles from classic tectonic theory and contemporary digital design pedagogy. Specifically, the scale operationalizes Kenneth Frampton's (1995) differentiation between "ontological" construction and "scenographic" representation, alongside Eduard Sekler's (1965) definition of tectonics as the expressive realization of structural stability. To translate these theoretical constructs into quantifiable metrics, criteria were established based on the geometric and cross-scalar verification protocols required in professional architectural practice.

Scoring assignments (Levels 1 to 5) are strictly anchored to the presence or absence of structural discrepancies during a cross-examination of standard presentation sets. A project is classified under Level 5 (Integrated) if there is a seamless, bidirectional verification between the 3D visual shell and the 1:20 technical documentation. Levels 3 and 2 (Atmospheric/Scenographic) are assigned when secondary or primary structural logic lacks continuous load-bearing paths despite graphic sophistication. Level 1 (Fragmented) represents a total geometric contradiction (e.g., mismatched roof profiles between sections and renders). The 37 senior-level projects were audited by cross-checking individual portfolios against these explicit geometric thresholds, filtering out subjective aesthetic evaluations to ensure a calibrated diagnosis.

The Technical Audit evaluation framework utilizes the Tectonic Integrity Scale (TIS) to quantify coherence across scales, from 1:500 urban layouts to 1:20 construction details. This methodology assesses the student's ability to maintain a unified logic against the seductive potential of digital tools (Schmidt, 2007). As outlined in the methodological flowchart (Figure 1), the audit functions as a teaching strategy to ensure the integration of professional knowledge (Soliman, 2017) through a three-stage comparative process. This structured workflow guarantees a rigorous transition from the initial evaluation of plan-section-render alignment to the final categorization of projects based on their tectonic Integrity.

First, Plan-Section-Render Alignment is investigated to determine if spatial features depicted in renderings—such as clerestory windows or vaults—have rational structural equivalents in technical sections. This is followed by a Structural Rationality Audit, evaluating whether selected systems—such as space frames, trusses, or cable-stayed systems—physically meet wide-span requirements (Şahin Diri et al., 2025). Finally, the audit examines Cross-Scalar Consistency, ensuring that 1:20 scale system details align with the primary structural logic. This verifies the harmony between the material "appearance" in digital images and the actual "connection details" in technical drawings.

Regarding ethical procedures, voluntary "Informed Consent" was obtained from all students. The research adhered to universal academic ethical principles, using anonymization protocols to protect participant privacy. Based on the TIS metric, projects were categorized into the "Reference Group," "Illusion Trap," and "Representational Collapse" to facilitate a comparative analysis of tectonic integrity. The latter category specifically identifies the emergence of an 'Ontological Void'—the technical and existential gap where architectural representation exists without a viable structural or material basis.

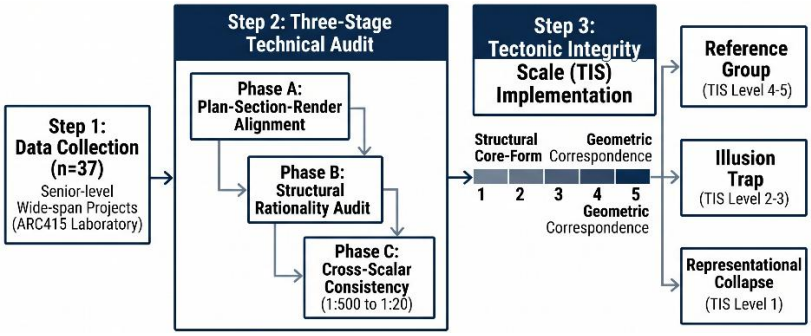


Figure 1. Methodological flowchart of the multi-scalar Technical Audit framework, illustrating the evaluation process from initial data collection through the application of the Tectonic Integrity Scale (TIS) to final project classification (Source: Author).

3. ANALYSIS OF CASE STUDIES: FROM TECTONIC INTEGRITY TO DIGITAL ILLUSION

This section analyzes semester projects through the lenses of 'Tectonic Integrity' and 'Digital Illusion'. The analysis evaluates both visual output and the technical consistency underlying these representations. Each project is assessed using the Tectonic Integrity Scale (TIS) to ensure an objective technical audit.

The TIS framework uses five criteria to bridge the gap between digital representation and physical reality. These criteria, derived from tectonic theory and digital morphogenesis, begin with Geometric-Structural Correspondence. This criterion measures the 'Ontological Link'—the verifiable physical connection between form and structural logic based on the concept of the structural core-form (Sekler, 1965). This relationship is quantified through the TIS Level, a hierarchical metric from Level 1 (Fragmented) to Level 5 (Integrated).

To verify this integrity, the audit examines 3D-Section Alignment, identifying any 'Tectonic Gap'—the logical discrepancy between the building skin and its technical assembly (Valena et al., 2011). This is further refined by inspecting Detail Scale/Focus, which ensures scalar continuity from macro-massing to technical junctions (Frampton, 1995). Finally, Tectonic Quality utilizes the 'Visual Shield' lens (Oxman, 2008) to determine whether digital tools functioned as design validators.

The hierarchy and definitions of these metrics are detailed in Table 1. Following this audit, projects are categorized into three groups: Reference Projects (TIS Level 4-5), representing the "Full Tectonic Maturity"; The Illusion Trap (TIS Level 2-3), where aesthetic persuasion masks structural voids; and the Collapse of Representation (TIS Level 1), occurring when digital aesthetics fail to conceal fundamental structural impossibilities.

Table 1. Tectonic Integrity Scale (TIS) for Cross-Scalar Evaluation (Source: Author).

Level	Classification	Definition of Geometric-Structural Correspondence
5	Integrated	Full tectonic Integrity; every digital form has a direct, rational 1/1 structural counterpart.
4	Coherent	Structural alignment; the form is rational, with minor coordination gaps in secondary details.
3	Atmospheric	Semi-illusion; high visual persuasion masks unsupported or disconnected structural members.
2	Scenographic	Visual masking; the digital shell functions as a purely decorative envelope with no structural logic.
1	Fragmented	Ontological collapse; no geometric or logical link between the rendering and the technical sheets.

3.1. Reference Projects: Full Tectonic Maturity

The projects in this group define the "Full Tectonic Maturity" by maintaining a seamless transition between conceptual visualization and technical execution. Their success lies in synthesizing structure and construction into a unified tectonic expression, where visual form accurately articulates internal structural forces (Sekler, 1965). The primary evidence of this integration is documented in Figure A1 (See Appendix A), which demonstrates Technical Continuity—defined as the absence of geometric contradictions between the digital model and technical sections—across a four-stage comparative process. Complementing this visual matrix, the performance criteria in Table 2 highlight how these projects achieve Tectonic Integrity—the total alignment of the digital visual shell with its internal structural logic—through structural rationality and scalar coordination (Sandaker et al., 2019; Şahin Diri et al., 2025). In these cases, the volumetric correspondence between renderings and technical sections establishes a high benchmark for representational accuracy.

Pr 1 and Pr 3 exemplify this maturity through their management of complex geometries. Pr 1 achieves structural poetics by integrating a dynamic building mass across all layers. Beyond visual texture, it demonstrates multiscalar consistency, where geometric complexity is verified through a continuous documentation trail from 3D forms to 1/20 scale assembly logic. Similarly, Pr 3 utilizes a bi-axial roof design operating on a dual-direction structural logic. The synergy between its dynamic roof and rhythmic parametric facade ensures that visual complexity remains anchored in structural truth.

Pr 2 and Pr 4 further exhibit professional-grade maturity through balanced architectural interventions. Pr 2 demonstrates harmony between building mass, roof structure, and facade, reflecting a mastery of the design-to-production workflow. Its parametric facade is rationally integrated into the primary frame, transforming an aesthetic envelope into a performance-driven facade (Chilton, 2000). Conversely, Pr 4 uses precise, calculated interventions to transform a stable building form into a tectonic statement. By aligning facade panels with roof geometry, the project maintains high Representational Integrity—the verified consistency between the 3D finish and engineered construction logic.

Table 2. Comparative Matrix of Tectonic Integrity (Reference Group) (Source: Author).

Criteria	Pr 1	Pr 2	Pr 3	Pr 4
Geometric-Structural Correspondence	*Fully rationalized dynamic integration*	*High-level professional integration*	*Bi-axial structural rationalization*	*Balanced & viable form alignment*
TIS Level	*Level 5 (Integrated)*	*Level 5 (Integrated)*	*Level 5 (Integrated)*	*Level 5 (Integrated)*
3D-Section Alignment	*Full correspondence (Accurate volume)*	*Excellent alignment (Mass-structure harmony)*	*Full correspondence (Bi-axial logic)*	*High correspondence (Balanced form)*
Detail Scale / Focus	*Multiscalar assembly logic*	*Integrated facade & roof*	*Roof-facade synergy*	*Refined material junctions*
Tectonic Quality	*Structural poetics*	*Professional maturity / facade engineering*	*Structural dynamism & parametric harmony*	*Balanced aesthetics & buildability*

3.2. The Illusion Trap: Persuasion via Aesthetics

Projects in this group illustrate the 'Illusion Trap'—a condition where digital visual fidelity masks underlying structural incoherence. High-quality renderings and atmospheric effects act as a 'Visual Shield', utilizing graphical obfuscation to hide technical flaws during jury reviews (Oxman, 2008). Figure B1 (See Appendix B) documents this through a critical 'Tectonic Gap' (Valena et al., 2011)—a measurable lack of alignment between the digital skin and the structural section—revealed when perspectives are compared to technical drawings. Detailed results in Table 3 highlight where technical resolution was bypassed for visual persuasion.

Pr 5 and Pr 6 demonstrate a significant drop in technical continuity; their fluid geometries fail to translate into constructible structural logic. In Pr 5, the visual language suggests a sophisticated bi-axial roof, yet analytical diagrams reveal a simplistic single-axis system and an inadequately configured structural grid. Similarly, Pr 6 uses a double-shell strategy for organic massing, but technical sections expose a disconnected carrier system. The central roof fails due to an ambiguous mechanism lacking a rational load-bearing path. In both cases, high-end rendering serves as a mask, presenting a hyper-real simulation of a form whose structural logic remains unarticulated.

A different dimension of the trap is observed in Pr 7 and Pr 8, where the architectural envelope fails to integrate with internal reality. Pr 7 exhibits a profound disconnect where a well-conceived roof fails to synthesize with the building mass. The exterior acts as a detached 'Visual Mask'—a scenographic surface lacking tectonic depth—echoing Semper's (1989) warning against envelopes that fail to articulate internal constructive elements. Pr 8 represents the peak of this systemic bypass through exaggerated proportions and a redundant double-shell. Undesigned interstitial voids create a spatial paradox, sequestering spectators from the very architectural statement the building projects. Here, the image supersedes spatial experience, reducing the proposal to a simulation detached from physical reality (Baudrillard, 1994).

Table 3. Comparative Matrix of the Illusion Trap Group (Source: Author).

Criteria	Pr 5	Pr 6	Pr 7	Pr 8
Geometric-Structural Correspondence	Low (Unresolved bi-axial logic)	None (Fluid mass vs. Disconnected roof)	Moderate (Isolated roof success vs. mass disconnection)	Low (Redundant double-shell / Scalar excess)
TIS Level	Level 3 (Atmospheric)	Level 2 (Scenographic)	Level 3 (Atmospheric)	Level 2 (Scenographic)
3D-Section Alignment	Low (Mass-section discrepancy)	Severe mismatch (Shell-column disconnection)	Low (Incomplete envelope integration)	Moderate (Relative consistency / Functional disconnect)
Detail Scale / Focus	Unresolved interface logic	Ambiguous central roof mechanism	Exaggerated facade panel scaling	Undesigned interstitial voids
Tectonic Quality	Visual persuasion vs. structural void	Fluid illusion / Unresolved structural complexity	Structural clarity vs. integration failure	Plastic dynamism vs. Spatial redundancy

3.3. The Collapse of Representation: When Illusion Fails

This section analyzes projects where the link between digital representation and physical reality is severed. In these instances, the 'Visual Shield'—the use of graphical obfuscation to mask technical flaws—fails to conceal fundamental structural impossibilities. This 'Ontological Collapse'—defined here as the total failure of architectural imagery to represent a buildable reality—confirms that without a technical foundation, digital tools hinder architectural knowledge acquisition (Oxman, 2008). Figure C1 (See Appendix C) documents this disintegration, revealing an 'Ontological Void': a technical discrepancy where exterior perspectives project a finished product while structural sections expose a system that cannot exist physically. At this stage, the render becomes a hyper-real simulation detached from the laws of physics (Baudrillard, 1994). Table 4 details the quantitative data reflecting this systemic failure and tectonic inconsistency.

Technical outcomes highlight where the 'Tectonic Gap' (Valena et al., 2011)—the measurable lack of alignment between digital skin and technical assembly—reaches its maximum extent. This confirms the failure of the 'Digital Illusion' to translate into constructible logic. Disintegration is evident in Pr 9 and Pr 11, where projects disregard material logic and thermodynamics. Pr 9 features clerestory windows and a glazed roof in renderings that are absent from technical sections. Similarly, Pr 11 functions as a 'random geometry generator'; its roof is a formless line in sections, contradicted by an alienated cable-stayed detail in technical sheets. In both, utilizing fully glazed roofs for a gymnasium creates excessive solar heat gain, proving digital tools were used for seductive imagery rather than design verification.

Table 4. Comparative Matrix of the Representational Collapse Group (Source: Author).

Criteria	Pr 9	Pr 10	Pr 11	Pr 12
Geometric-Structural Correspondence	*Disconnected (Ontological contradiction)*	*Minimal (Fragmented vault logic)*	*Disconnected (Single-line section vs. cable-stayed detail)*	*Disconnected (Inconsistent perspective fragments)*
TIS Level	*Level 1 (Fragmented)*	*Level 1 (Fragmented)*	*Level 1 (Fragmented)*	*Level 1 (Fragmented)*
3D-Section Alignment	*Total mismatch (Clerestory & roof variance)*	*Severe mismatch (Missing cantilevers)*	*Ontological collapse (Zero-thickness roof)*	*Severe mismatch (Vault vs. flat roof)*
Detail Scale / Focus	*Material incoherence*	*Absence of Envelope (X-ray)*	*Alienated / borrowed system*	*Inconsistent massing features*
Tectonic Quality	*Tectonic disintegration (Random geometry)*	*Tectonic absence / Embryonic massing*	*Random geometry / thermal & structural failure*	*Image curation / Deceptive simulation*

A different facet of this collapse appears in Pr 10 and Pr 12, where the architectural object fails to achieve a coordinated three-dimensional totality. Pr 10 exhibits a 'X-ray effect'—exposing internal elements without a coherent facade strategy—while structural cantilevers seen in 3D diagrams vanish in sections. This process terminates in Pr 12, the group's most deceptive example, where atmospheric renderings obscure fundamental geometric-proportional failures; a vaulted roof in the section appears as a flat terrace in the render. By remaining 'locked' into specific camera angles, these projects bypass the design process in favor of image curation. Consequently, architectural representation loses its meaning, leaving fragmented forms that fail the basic tests of architectural legitimacy and construction laws.

4. FINDINGS AND DISCUSSION: THE IMPACT OF DIGITAL TOOLS ON ARCHITECTURAL PEDAGOGY

The structured audit of 37 technical portfolios reveals a profound disconnect between advanced digital proficiency and fundamental tectonic understanding. While contemporary digital tools significantly expand the formal boundaries of wide-span structural design, they simultaneously generate a pervasive 'technical fog' that systematically separates superficial architectural intent from deep constructive reality. This acute tension between digital aesthetic persuasion and raw technical necessity (Al-Qawasmi, 2004) represents a core, systemic pedagogical challenge in modern design studios. As contemporary architectural production increasingly distances itself from its predigital roots, maintaining structural and construction logic within highly abstract, pixelated environments remains immensely difficult (Schmidt, 2007). Under the influence of unregulated digital workflows, the digital model frequently shifts from a rigorous tool for structural verification to a seductive medium primarily utilized for masking critical coordination errors. To empirically evaluate the operational limits of this digital masking effect within the studio, a comprehensive analysis of student outputs was conducted.

The resulting data from this systematic audit demonstrates a direct, empirical correlation between 'Tectonic Integrity'—the verified, cross-scalar alignment between digital architectural representation and structural feasibility—and final technical performance metrics. While an elite cohort of students successfully mastered this Geometric-Structural Correspondence, a significant majority of the studio utilized a 'Visual Shield'—defined here as advanced graphical obfuscation deployed during evaluations to mask technical contradictions—to deliberately obscure structural inconsistencies from the reviewers' gaze.

Quantitative data compiled in Table 5 indicates that only 24% of the analyzed projects successfully achieved Full Tectonic Maturity (TIS Level 4), while 35% exhibited severe cross-scalar inconsistencies categorized as 'Representational Collapse' (TIS Level 1). Crucially, these diagnostic results were not based on subjective aesthetic appreciation or stylistic preferences, but on verifiable structural consistency measured uniformly via the Tectonic Integrity Scale (TIS). To eliminate traditional jury noise and maximize baseline internal consistency during this initial pilot phase, the technical audit was executed through a highly calibrated, single-auditor protocol. Under this rigorous baseline, projects failing the strict 'Section-to-Render Alignment' were systematically downgraded, regardless of their rendering quality or graphic sophistication, thereby upholding the studio's pedagogical commitment to tectonic truth and laying a controlled empirical foundation for subsequent multi-evaluator validation stages.

This diagnosed 'technical fog,' however, is not uniform across the portfolio; it thickens specifically at critical scalar transition points where the designer fails to reconcile macro-massing parameters (1:500) with micro-level assembly logic (1:20). This severe scalar gap ultimately transforms the digital model into a fragmented, scenographic object rather than a coherent, gravity-bearing tectonic system.

Table 5. Distribution of Technical Performance Categories Based on Tectonic Integrity and Audit Outcomes (n=37) (Source: Author).

Project Category	TIS Level & Classification	Number of Projects (Percentage)	Tectonic Characteristics
Reference Group	*Level 5-4: Integrated / Coherent*	*9 Projects (24%)*	*High alignment between digital image and structural logic; full geometric correspondence.*
Illusion Trap	*Level 3-2: Atmospheric / Scenographic*	*15 Projects (41%)*	*Visual persuasion masks technical gaps; digital shell lacks a rational load-bearing path.*
Representational Collapse	*Level 1: Fragmented*	*13 Projects (35%)*	*Ontological void; complete failure in structural logic and cross-scalar coordination.*

4.1. The Misleading Power of AI-Generated Imagery in Design Education

Artificial Intelligence (AI) and real-time rendering have fundamentally altered student priorities, exacerbating the 'Illusion Trap'—where visual fidelity masks structural incoherence—and the resulting 'Collapse of Representation'. AI-generated imagery necessitates a critical rethinking of studio culture and authorship (Karadağ, 2025), as it complicates whether a design reflects intentional technical agency or a generative algorithm. This shift risks prioritizing aesthetic 'output' over the cognitive 'process,' leading to a superficial engagement with structural complexities (Karadağ, 2025). In this context, AI should function as a pedagogical instrument mediating design knowledge rather than a mere production tool (Gunaydin Donduran et al., 2024).

While Generative AI (GenAI) is theorized to enhance aesthetics and formal exploration (Alamasi et al., 2026), the rapid adoption of advanced real-time rendering and generative tools potentially facilitates hyper-realistic atmospheres that risk masking structural foundations. Within this evolving digital workflow, the reliance on automated visualization software might detach the visual output from the technical process (Sabono, 2025; Lu, 2024). As observed in Pr 12, these tools create a 'Double Illusion'—a simultaneous deception of the jury through atmospheric rendering and a loss of technical control by the designer—leading to fragmented geometries.

Maintaining continuity between representation and construction remains the primary tectonic challenge in the digital age (Schmidt, 2007). AI integration redefines technical agency (Chaillou, 2022), shifting the designer's role from proactive structural configuration to passive 'Image Curation'—the selection of visual outputs without a verified logic of assembly. This shift signifies an abdication of technical agency, where the architect acts as an external observer selecting visual outputs rather than the primary constructor of structural logic, a transition illustrated in the comparative cognitive framework (Figure 2). Consequently, the 'Double Illusion' is not merely a deception of the jury but a cognitive loss of control over the design's physical reality. As digital tectonics redefine the relationship between form and constructive logic (Liu & Lim, 2006), representation must reflect the technical assembly (Akgün et al., 2022).

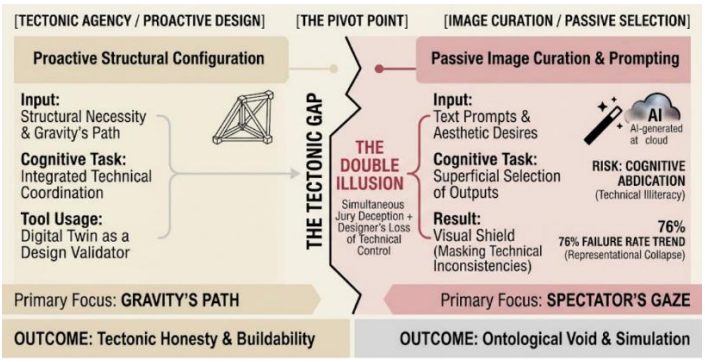


Figure 2. Comparative Cognitive Framework: Tectonic Agency vs. Passive Image Curation (Source: Author).

The high adoption rates of AI in structural form generation discussed in the literature contrast sharply with the technical outcomes observed in this study (Khogali, 2024). While global adoption is high, the 76% failure rate trend identified in the ARC415 studio suggests that without rigorous supervision and structured 'Technical Audits,' these tools merely facilitate a 'Scenographic Architecture' focused on the 'spectator's gaze' rather than 'gravity's path'. To avoid this, the pedagogical framework must bridge the gap between aesthetic intent and tectonic reality (Akgün et al., 2022), preventing digital models from becoming emotive narratives that bypass structural necessity (Sandres, 2022).

In this context, deploying a single-auditor technical evaluation framework was a deliberate and vital methodological imperative for this initial diagnostic phase. Traditional multi-member juries are routinely susceptible to the 'halo effect' of sophisticated imagery, often falling into aesthetic consensus driven by graphic persuasion. Therefore, a single, highly calibrated evaluator design was critical to eliminate this subjective aesthetic noise, thereby maximizing internal consistency and establishing a rigorous, uncompromised baseline across the Tectonic Integrity Scale (TIS) metrics. This controlled baseline intentionally lays the groundwork for the multi-evaluator, verification structures deployed in subsequent longitudinal stages of this research.

4.2. Re-evaluating the Jury: Shifting Focus from Image to Technical Process

The 37:1 student-to-instructor ratio in contemporary architectural education requires shifting from generic individual critiques to a transparent, collective 'Open-Audit' format. This strategy transitions students from conceptual intent to technical resolution, ensuring the design studio remains a space for integrated knowledge (Soliman, 2017). Viewing the studio as a creative-organizational structure allows instructors to manage complexity and transform the environment into a platform for collective knowledge exchange (Paker Kahvecioğlu, 2007). These collaborative laboratories encourage peer learning and build a resilient studio culture rooted in interaction over fragmentation (Qureshi, 2020; Hacihasanoglu, 2019).

Traditional multi-member juries, often distracted by AI-generated 'vibes'—hyper-realistic atmospheric effects lacking structural substance—cannot adequately evaluate complex, wide-span structures due to the pervasive 'halo effect' of digital rendering. Assessment models must therefore reward technical transparency and the student's ability to critically mediate between human creativity and machine output (Karadağ, 2025). The structural failure of the 'Collapse of Representation' group—defined as projects where architectural imagery possesses no viable constructive resolution to rectify errors—highlights a digital production-driven 'Technical Illiteracy'. Pedagogy must prioritize visual literacy, ensuring students interpret the gap between a persuasive render and its internal constructive logic (López-León, 2015). This requires a rigorous understanding of the structural basis and load-bearing capacities of materials (Şahin Diri et al., 2025).

To combat digital deception, evaluation should adopt the multi-scalar 'Technical Audit' methodology (Figs. A1, B1, C1), demanding a 1:1 correspondence between the 3D atmosphere and technical sections across multiple scales. The findings demonstrate that the 'Tectonic Gap' is most visible during scalar transitions; projects categorized under 'Representational Collapse' often exhibit a systemic failure to translate macro-level massing (1:500) into viable micro-level assembly (1:20). This scalar gap functions as the ultimate litmus test for tectonic integrity; while the 'Visual Shield' can maintain architectural persuasion at a macro-distance (1:500), it inevitably shatters when subjected to the granular scrutiny of technical assembly (1:20), exposing the ontological void that lies beneath the high-end render. As explicitly demonstrated in Figure 3, a hyper-realistic atmosphere (left panel) often functions solely to mask a non-existent or physically impossible structural system (right panel), proving that digital persuasion can easily conceal a profound representational collapse. Crucially, students who lack the technical proficiency to bridge this scalar divide frequently retreat into the 'Visual Shield' of atmospheric rendering, substituting constructive truth with digital illusion.

Maintaining 'Tectonic Integrity'—the verified alignment between creative experimentation and constructive reality—is vital to establish a true tectonic benchmark in the digital era (Schmidt, 2007). This approach preserves architectural quality while leveraging digital innovations (Liu & Lim, 2006; Mahmood & Al-Alwan, 2023). Furthermore, the heavy dependency on digital tools in modern curricula necessitates a holistic, audited approach to their contribution to the studio environment (Ceylan et al., 2024).

AI’s handling of creative tasks indicates a shift in the architect’s role rather than replacement; practitioners must strengthen technological competence to master these generative tools (Sabono, 2025). AI-assisted workflows require traditional architectural scrutiny to ensure structural viability (Lu, 2024; Gunaydin Donduran et al., 2024). Supervised GenAI integration can improve design quality within a pedagogical framework prioritizing cognitive development and full tectonic maturity (Alamasi et al., 2026; Khogali, 2024). AI-integrated curricula (Alymani, 2024) must use the Technical Audit as a pedagogical bridge to maintain architectural agency in a software-driven future.

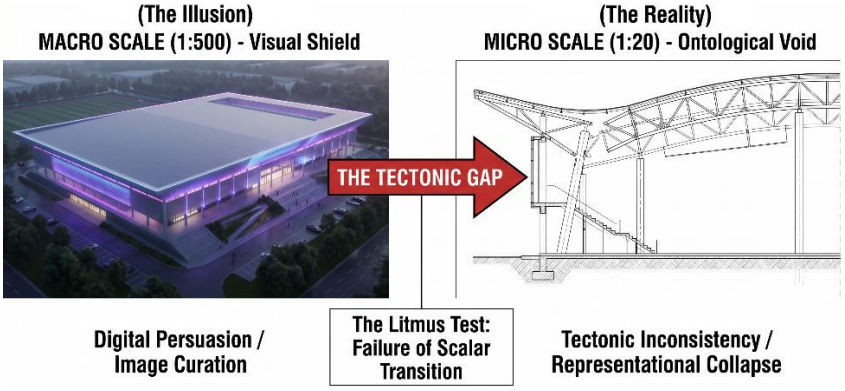


Figure 3. Analytical comparison of the 'Tectonic Gap', illustrating how a hyper-realistic architectural atmosphere (Visual Shield) effectively masks a non-existent structural system, creating an 'Ontological Void' during scalar transition (Source: Author).

Although the structural disconnects identified herein represent objective geometric discrepancies verified through a singular technical audit, this controlled baseline was a deliberate and vital methodological choice for this initial diagnostic phase. Deploying a single, highly calibrated evaluator effectively eliminated the diverse aesthetic, subjective, and conflicting biases that traditionally introduce noise into multi-member juries, thereby maximizing internal consistency. This highly controlled baseline intentionally sets the stage for advanced inter-rater validation. To ensure broader institutional replicability beyond a single instructor's evaluation, subsequent longitudinal phases of this research are structured to transition into a multi-evaluator, "Independent Evaluator Framework" quantified via Fleiss' Kappa and Intraclass Correlation Coefficient (ICC) metrics, ensuring the long-term scalability of the TIS methodology.

4.3. Limitations of the Study

While the findings provide significant insights into the intersection of digital fluency and tectonic integrity, this research acknowledges certain methodological boundaries. The study is primarily designed as an in-depth laboratory analysis centered on the specific pedagogical context of the ARC415 studio at Istanbul Gelişim University. Consequently, the empirical scope is defined by the rigorous technical parameters of wide-span sports facilities and the academic performance of a specific student cohort.

Regarding the sample size, the selection of 37 projects was intended to allow for a high-fidelity, cross-scalar scrutiny of technical portfolios. While this sample provided the necessary qualitative and quantitative depth to explore the application of the Tectonic Integrity Scale (TIS), the research recognizes that these findings represent a highly controlled pilot environment. Generalizing these results to the wider spectrum of architectural education requires expanded datasets and multi-institutional comparisons to ensure comprehensive external validity. To address this, future phases of this research will upscale the methodology into a comprehensive longitudinal matrix, deploying the TIS framework across multiple design studios and diverse academic institutions over consecutive semesters.

Furthermore, as anticipated in the preceding analytical discussions, the decision to utilize the course instructor as the sole auditor was a deliberate and vital methodological choice for this initial application phase. This approach ensured an uncompromised, structurally rigorous application of the TIS metrics, effectively eliminating the diverse aesthetic noise, subjective preferences, and conflicting biases that traditionally introduce variances into multi-member juries. By establishing this unified technical lens, the study maximized internal consistency during the formulation of the metric.

However, to ensure broader institutional replicability beyond this controlled baseline, subsequent longitudinal phases are explicitly structured to transition into an "Independent Evaluator Framework". Under this framework, trained graduate-level architectural researchers will independently audit student projects using standardized drawing sets in a controlled research setting. The inter-rater reliability and calibration of the TIS rubric across these independent coders will be statistically quantified using Fleiss' Kappa and Intraclass Correlation Coefficient (ICC) metrics. By formalizing these advanced statistical calibration steps, this initial phase serves as the vital theoretical and methodological baseline necessary to deploy a standardized, multi-evaluator quality control model in architectural education.

5. CONCLUSION

This study explores the dual-edged impact of digital visualization in architectural education through an initial diagnostic multi-scalar 'Technical Audit' methodology. The preliminary findings suggest a paradoxical risk within the analyzed contemporary studio environment: an increase in digital visual persuasion frequently correlates with an acute vulnerability in tectonic rationality. These diagnostic results are conceptualized and summarized across three primary analytical dimensions:

Firstly, the 'Illusion Trap' signifies a profound pedagogical challenge. The baseline finding that a majority of audited projects failed to achieve structural coordination indicates that the capacity of hyper-realistic representation to obscure technical reality leads to a critical deficit in visual literacy. Within this framework, advanced renderings and atmospheric effects act as a 'Visual Shield' during evaluations, effectively masking profound structural coordination errors through graphic obfuscation. This research demonstrates that the ability to generate sophisticated imagery does not inherently grant students the cognitive capacity to critically analyze, scale, or justify constructive logic. Consequently, this severe disparity between visual finish and structural depth shifts the evaluative focus from tectonic rigour to a "scenographic aesthetic," ultimately endangering the architectural ontology of the proposed structure.

Secondly, the 'Collapse of Representation' illustrates how the uncontrolled misuse of generative digital tools can completely sever the epistemic link between architectural representation and physical, structural laws. Significant technical errors—such as "floating roofs," discontinuous load-bearing paths, or fundamentally mismatched geometries—are clear symptoms of a pedagogical crisis where students lose the ability to technically interpret and cross-examine their own designs. In this context, the digital model ceases to function as a verification tool, degenerating instead into a "random geometry generator." This cognitive detachment is severely exacerbated when unsupervised, AI-driven visualizations trap students within a hyper-aesthetic shell that they can neither technically decipher nor constructively justify.

Finally, the full tectonic maturity demonstrated by the Reference Group—the only cohort to successfully achieve the definitive tectonic benchmark within the scale—proves that pedagogical success relies on treating the digital model as a rigorous "Digital Twin" of the structural and material system. These exemplary projects confirm that architectural quality is recovered only when visual representation and multi-scalar technical coordination are tightly integrated through the objective metrics of this pilot application of the Tectonic Integrity Scale (TIS). The architectural design studio must remain a critical space that prioritizes active cognitive development and technical agency over passive 'Image Curation'—the arbitrary selection of unverified visual outputs lacking an underlying logic of physical assembly. By fostering targeted 'Tectonic AI Workflows' centered on enhancing cross-scalar visual literacy, the ultimate goal is to ensure that digital tools bring architectural students closer to constructive rationality rather than distancing them from physical and material reality.

Building upon the comprehensive institutional upscaling targets and multi-evaluator calibration frameworks outlined in the methodological limitations (Section 4.3), future pedagogical applications aim to operationalize a process-based filtering mechanism within the design studio timeline. This approach mathematically differentiates between the initial, highly speculative conceptual phase—where the alignment between GenAI outputs and architectural/structural logic stands at an exploratory ~50%—and the final submission stage, where students apply AI-driven 'visual polish' exclusively to structurally finalized digital models, targeting a strict ~90% fidelity with the underlying computer-aided substrate. Future research will explore the formalization of this dual-phase integration as a standardized jury cross-examination metric, explicitly testing whether students have filtered and calibrated atmospheric renderings against the verified technical reality of their CAD/BIM structural substrates.

Furthermore, upon broader validation, the proposed TIS framework has the potential to offer a structured, objective rubric for the standardized verification of Student Performance Criteria (SPC) required by international accreditation bodies such as MİAK and NAAB. By seamlessly integrating this technical audit methodology into the modular assessment criteria of progressive design studios, architectural programs could potentially provide transparent evidence of professional and constructive competency. This integration ensures that the deceptive 'halo effect' of digital representation is systematically barred from bypassing the rigorous, accredited quality standards of global architectural education.

Acknowledgement

The author extends his sincere gratitude to Nadeen Hussein Hadi Al-Suwailih for her operational support, assistance in data organization, and dedication to supporting studio processes and documentation throughout this research.

Information Note

The author served as the studio advisor for the ARC415 Architectural Design 5 course during the Fall 2025 semester. Selected projects from this group are referenced throughout this article and are coded from Pr 1 to Pr 12. To acknowledge their academic dedication and distinct technical success, the names of students in the Reference Group and selected participants are listed as follows: Japhet Luendo (Pr 1), Nadeen Hussein Hadi Al-Suwailih (Pr 2), Abdullahi Mohamed Jama (Pr 3), Aysu Simra (Pr 4), Mohammed Sajid Ghaleb Salihi (Pr 5), Noura Khaled Abdel Razzaq Habashneh (Pr 6), and Jana Aldrees (Pr 7). For the remaining works (Pr 8 through Pr 12), the projects are kept anonymous to maintain professional privacy.

Ethical Considerations

In accordance with universal ethical standards, participation in this study was based on rigorous, voluntary informed consent protocols. Prior to the investigation, an internal ethical review was conducted by the principal investigator, and formal written consent was obtained from all participating students, granting explicit permission for the academic processing and publication of their design portfolios. The names of students who achieved high distinction (The Reference Group: Pr 1 – Pr 4) and specific participants who provided identified consent are disclosed to acknowledge their distinct academic efforts. Conversely, to protect the professional prospects of students in the early stages of their careers, projects exhibiting significant technical-visual discrepancies (The Collapse Group) have been kept strictly anonymous.

Furthermore, individual academic grades have been entirely excluded from the dataset to guarantee absolute participant privacy; instead, projects are evaluated exclusively based on their performance levels within the Tectonic Integrity Scale (TIS). The author emphasizes that the "fail" or "collapse" classifications used in this specific academic audit are not a judgment on the students' overall talent or future potential as architects. Instead, they refer to a "Tectonic Disconnect"—a systemic challenge where digital tools inadvertently separate visual representation from structural coordination. These shortcomings are viewed not as ultimate failures, but as essential learning milestones. The research operates on the belief that a student's creative capacity is not defined by a single grade; rather, the rigorous critique process during the studio is intended to catalyze their professional development and future technical proficiency. This study was formally reviewed and approved by the Institutional Ethics Committee of Istanbul Gelisim University (Approval Date: March 18, 2026, Meeting No: 2026-04, Decision No: 2026-04-68).

Declaration of Competing Interest

The author declared no potential conflict of interest with respect to the research, authorship, and/or publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Statement on AI Usage

The author used an AI tool as a technical writing assistant during the preparation of this manuscript. The tool was utilized for linguistic refinement and proofreading. However, the core theoretical framework (Tectonic Integrity Scale), the data collection process, the technical audit of the architectural projects, and the final interpretation of the results were developed exclusively by the author. All AI-generated suggestions were critically reviewed and validated by the author to ensure academic accuracy and integrity.

REFERENCES

Akgün, Y., Erkarslan, Ö. E., & Kavuncuoğlu, C. (2022). Tectonics of kinetic architecture: Moving envelope, changing space and the shades of the shed. *Frontiers in Built Environment, 8*, 1006300. https://doi.org/10.3389/fbuil.2022.1006300

Alamasi, R., Asfour, O. S., & Ashmeel, R. (2026). The impact of generative AI on architectural design education: insights from hands-on experience with architecture students. *Ain Shams Engineering Journal*, *17*, 103879. https://doi.org/10.1016/j.asej.2025.103879

Al-Qawasmi, J. (2004). Digital media in architectural design education: reflections on the e-studio pedagogy. Art, Design & Communication in Higher Education, 4(1), 33–47. https://intellectdiscover.com/content/journals/10.1386/adch.4.3.205/1

Alymani, A. A. A. (2024). Integrating Artificial Intelligence Rendering Tools in Design: Integrating AI as teaching methods in architectural education. *Proceedings of the International Conference on Architecture and Design*, eCAADe, 2(42), 629-638. https://papers.cumincad.org/data/works/att/ecaade2024_47.pdf

Baudrillard, J. (1994). Simulacra and simulation (S. F. Glaser, Trans.). University of Michigan Press.

Ceylan, S., Şahin, P., Seçmen, S., Somer, M. E., & Süher, H. K. (2024). The contribution of digital tools to architectural design studio: A case study. *Ain Shams Engineering Journal*, *15*(4), 102795. https://doi.org/10.1016/j.asej.2024.102795

Chaillou, S. (2022). Artificial intelligence and architecture: From research to practice. Birkhäuser.

Karadağ, D. (2025). AI in architectural education: Rethinking studio culture. PLANARCH- Design and planning research, 9(2), 243-253. https://doi.org/10.54864/planarch.1749891

Frampton, K. (1995). Studies in tectonic culture: The poetics of construction in nineteenth and twentieth century architecture. The MIT Press.

Gunaydin Donduran, C., Kasali, A., & Dogan, F. (2024). Artificial Intelligence as a Pedagogical Tool for Architectural Design Education. *Journal of Design Studio*, *6*(2), 219-229. https://doi.org/10.46474/jds.1533480

Hacihasanoglu, O. (2019). Architectural design studio culture. *Journal of Design Studio*, *1*(1), 5-15. https://dergipark.org.tr/en/download/article-file/775310

Hassanpour, B., & Şahin, N. P. (2021). Technology adoption in architectural design studios for educational activities. *Technology, Pedagogy and Education, 30*(4), 491-509. https://doi.org/10.1080/1475939X.2021.1897037

Khogali, H. A. (2024). *Architecture and artificial intelligence*. Scholars' Press.

Liu, Y. T., & Lim, C. K. (2006). New tectonics: A preliminary framework involving classic and digital thinking. *Design Studies*, *27*(3), 267-307. https://doi.org/10.1016/j.destud.2005.11.008

López-León, R. (2015). Developing visual literacy in Design Students. In R. VandeZande, E. Bohemia, & I. Digranes (Eds.), *Proceedings of the 3rd International Conference for Design Education Researchers* (Vol. 4, pp. 1618-1628). Aalto University. https://dl.designresearchsociety.org/conference-volumes/44/

Lu, Y. (2024). *Artificial Intelligence applied on today's urban and architectural conceptual design- A competition case study* (Master's thesis). Politecnico di Torino, Architecture Construction City. https://webthesis.biblio.polito.it/34505/

Mahmood, Y. B., & Al-Alwan, H. A. S. (2023). Tectonics and sustainable architecture: The notion of classical and digital sustainable tectonics in architecture. *Journal of the International Society for the Study of Vernacular Settlements- ISVS e-journal*, *10*(8), 457-477. https://isvshome.com/pdf/ISVS_10-8/Old%20Files/ISVSej_10.8.31_Yosor.pdf

Oxman, R. (2008). Digital architecture as a challenge for design pedagogy: Theory, knowledge, models and medium. Design Studies, 29(2), 99–120. https://doi.org/10.1016/j.destud.2007.12.003.

Özorhon, G., Nitelik Gelirli, D., Lekesiz, G., & Müezzinoğlu, C. (2025). AI-assisted architectural design studio (AI-a-ADS): How artificial intelligence join the architectural design studio? *International Journal of Technology and Design Education, 35*, 1999-2023. https://doi.org/10.1007/s10798-025-09975-0

Paker Kahvecioğlu, N. (2007). Architectural design studio organization and creativity. *ITU AIZ*, *4*(2), 6-26. https://www.az.itu.edu.tr/jfa/article/view/568

Pallasmaa, J. (2011). The embodied image: Imagination and imagery in architecture. John Wiley & Sons

Perez-Gomez, A., & Pelletier, L. (1997). Architectural representation and the perspective hinge. The MIT Press.

Qureshi, H. (2020). Collaborative architectural design studio environment: An experiment in the studio of Architectural Design-I. *Archnet-IJAR: International Journal of Architectural Research*, *14*(2), 303-324. https://doi.org/10.1108/ARCH-12-2018-0049

Sabono, F. (2025). A review: Exploring AI's role in architecture: Redefining new design interactions. *DIMENSI: Journal of Architecture and Built Environment*, *52*(1), 27-43. https://doi.org/10.9744/dimensi.52.1.27-43

Sandaker, B. N., Eggen, A. P., & Cruvellier, M. R. (2019). The structural basis of architecture (3rd ed.). Routledge.

Sandres, H. (2022). 3D architectural models as persuasive tools: A comparative study of visual strategies in popular vs. high-end architecture. International Seven Multidisciplinary Journal, 1(2). https://doi.org/10.56238/isevmjv1n2-020

Schmidt, A. M. D. (2007). *The Tectonic Practice: In the transition from the predigital to the digital era*. Aalborg Universitet. https://vbn.aau.dk/ws/files/549487922/The_Tectonic_Practice_PHD_AMDS.pdf

Sekler, E. F. (1965). Structure, construction, tectonics. In G. Kepes (Ed.), Structure in art and in science (pp. 89–95). Braziller.

Semper, G. (1989). The four elements of architecture and other writings (H. F. Mallgrave & W. Herrmann, Trans.). Cambridge University Press.

Soliman, A. M. (2017). Appropriate teaching and learning strategies for the architectural design process in pedagogic design studios. *Frontiers of Architectural Research*, *6*(2), 204-217. https://doi.org/10.1016/j.foar.2017.03.002

Şahin Diri, B., Yazıcı, M., & Yıldız, Ö. (2025). A comparative analysis on wide span structures. *Journal of Architectural Sciences and Applications (JASA), 10*(2), 863-891.

Valena, T., Avermaete, T., & Valena et al., G. (2011). Structuralism reloaded: Rule-based design in Architecture and Urbanism. Axel Menges, Stuttgart.

Yildirim, S. G. (2025). Integration of theory and practice in building construction course; A case study-based evaluation. *Uluslararası Akademik Birikim Dergisi, 8*(4), 677-690. DOI: 10.5281/zenodo.17397382

Yildirim, S. G., Baur S. (2025). Rethinking structural design education through boundary conditions and design flexibility in PBL. *Asean Journal of Engineering Education, 9*(1), 11-21. https://doi.org/10.11113/ajee2025.9n1.184

Yildirim, S. G., Erol İ. (2025). Comparative evaluation of human and AI-centered design approaches; A futuristic interior space concept. *NEW ERA International Journal of Interdisciplinary Social Researches, 10*(30), 29-50. https://doi.org/10.5281/zenodo.17391726

Appendix A

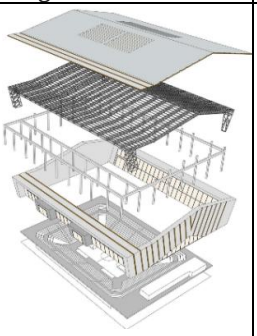
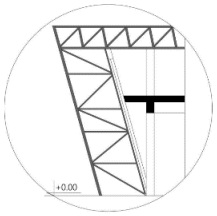
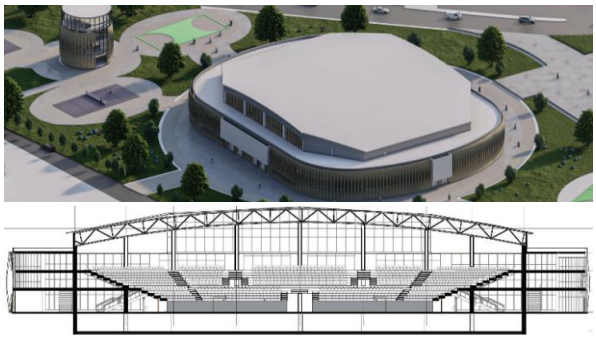
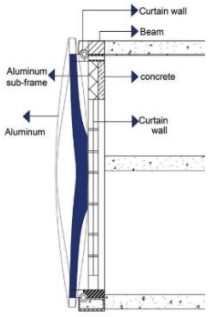
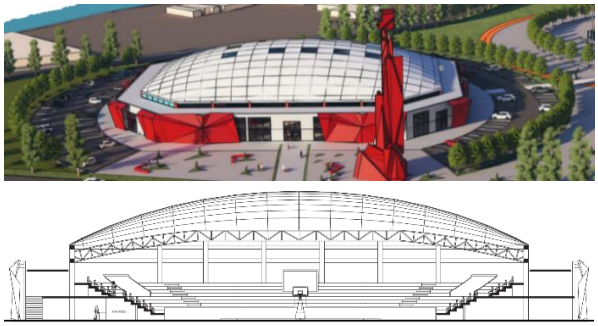
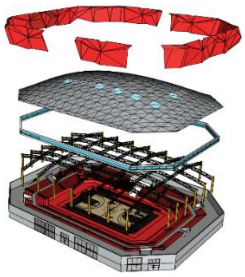
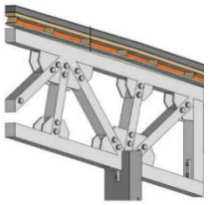
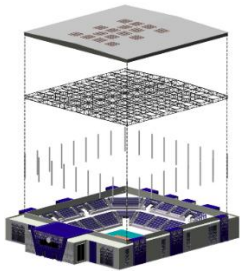
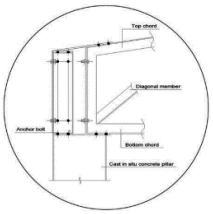
	Building Mass and Section	Diagram	System Detail
Pr 1			
Pr 2			
Pr 3			
Pr 4			

Figure A1. Visual Audit of the Reference Group (Source: Compiled by the author based on student projects referenced in the Information Note).

Appendix B

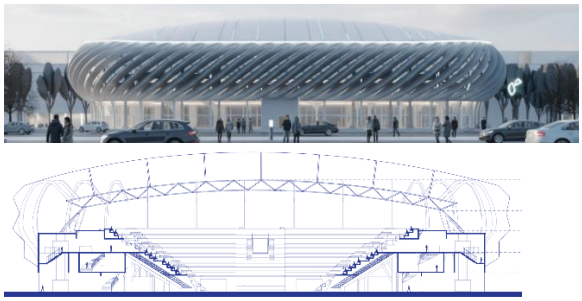
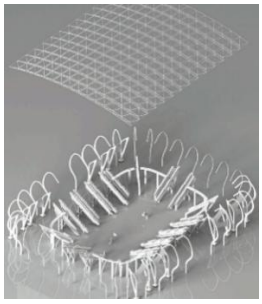
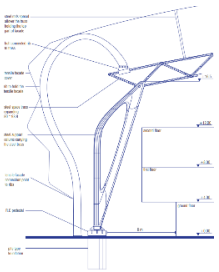
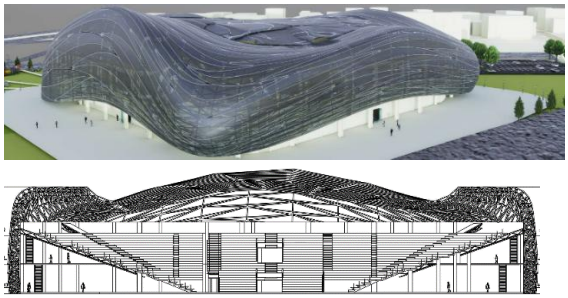
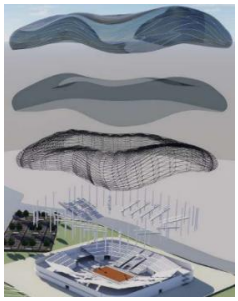
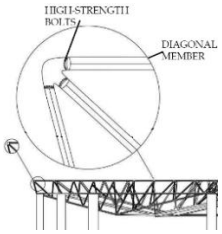
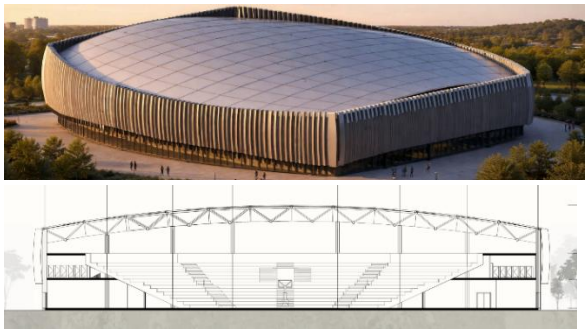
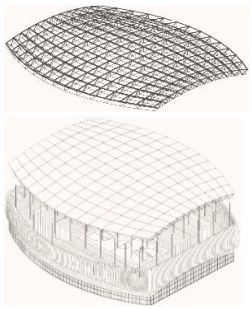
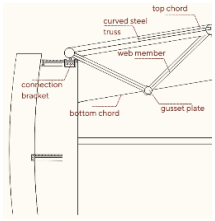
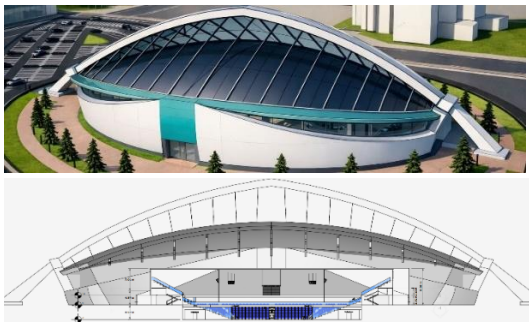
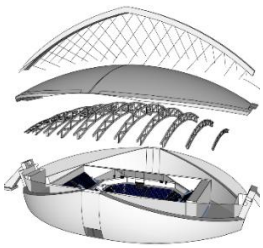
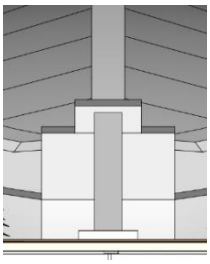
	Building Mass and Section	Diagram	System Detail
Pr 5			
Pr 6			
Pr 7			
Pr 8			

Figure B1. Visual Audit of the Illusion Trap Group (Source: Compiled by the author based on student projects referenced in the Information Note).

Appendix C

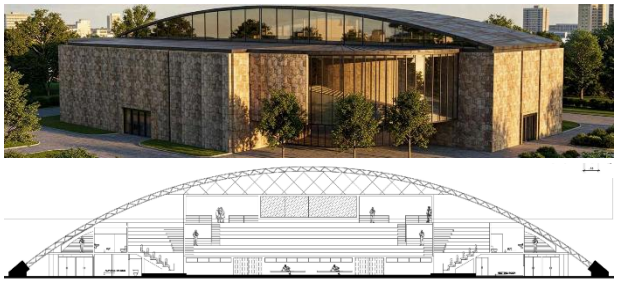
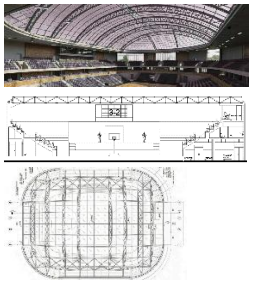
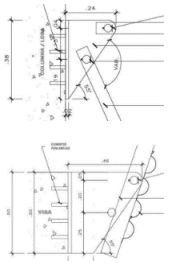
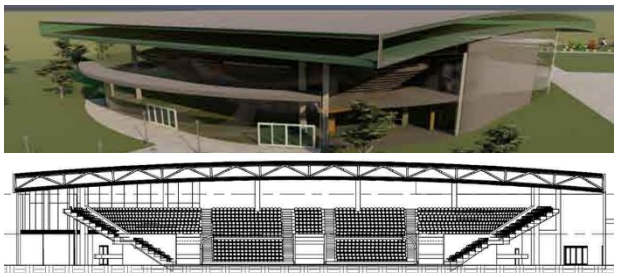
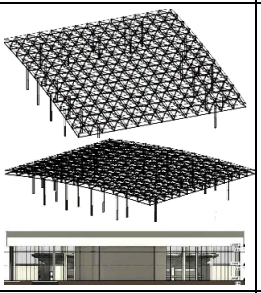
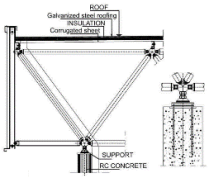
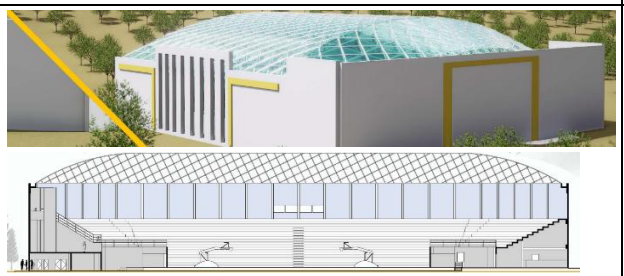
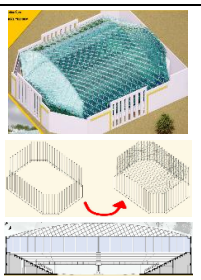
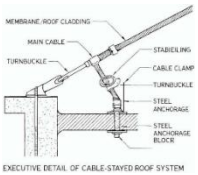
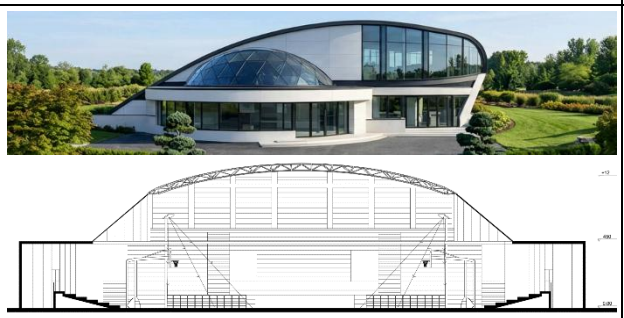
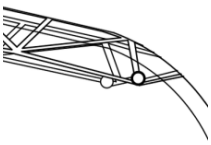
	Building Mass and Section	Diagram	System Detail
Pr 9			
Pr 10			
Pr 11			
Pr 12			

Figure C1. Visual Audit of the Representational Collapse Group (Source: Compiled by the author based on student projects referenced in the Information Note).