Students' Awareness and Perception of AI Integration in Packaging Design and Marketing: A Classroom-Based Case Study

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ABSTRACT

The rapid integration of Artificial Intelligence (AI) tools into creative and commercial industries necessitates a corresponding shift in higher education curricula. This paper presents a classroom-based case study investigating engineering students' awareness and perception of AI integration within a "Packaging Design and Technology" course at a technical university. The project required students to design a sustainable chip package and execute a TikTok marketing campaign, explicitly mandating the use of AI tools across the entire workflow; from ideation and graphic design to content creation and campaign strategy. Through surveys, analysis of the project brief, AI workflow examples, and a review of contemporary literature, this study establishes a framework for evaluating student AI literacy, ethical awareness, and perceived impact on creativity and efficiency. Preliminary findings suggest that structured, mandatory integration of AI in project-based learning is a critical pedagogical approach for bridging the skills gap between academic training and industry demands in the converging fields of design, engineering, and marketing.

Keywords: AI integration in higher education, AI literacy in students, Ethical awareness in AI, AI enhanced packaging technology, green innovation in packaging, AI driven content creation

INTRODUCTION

The confluence of design, engineering, and marketing has been profoundly reshaped by the advent of generative Artificial Intelligence (GenAI). Tools capable of rapid ideation, asset generation, and data-driven optimization are moving from novelties to essential professional competencies. In the context of packaging, a discipline that bridges material science (engineering), aesthetics (design), and consumer engagement (marketing), AI offers unprecedented potential for innovation in sustainability, durability, and market appeal.

To prepare for future professionals, educational institutions must proactively integrate AI literacy into their core curriculum. This paper examines a specific instance of this integration: a project within the "Packaging Design and Technology" course at Universiti Teknikal Malaysia Melaka (UTeM). The project served as a controlled case study to observe and analyze students' engagement with AI. The central research questions guiding this study are:

A. What is the level of students' awareness regarding the range and application of AI tools relevant to packaging design and marketing?

B. What are students' perceptions of AI's impact on their creative process, technical efficiency, and ethical responsibilities within a project-based learning environment?

The subsequent sections will detail the theoretical framework, the case study methodology derived from the project brief, a discussion of anticipated findings, and the pedagogical implications of this mandatory AI integration.

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

AI in Design and Engineering Education

The literature on AI in design education highlights its role as a co- creator and accelerator rather than a mere tool [1]. AI systems can rapidly generate design variations, optimize structural integrity, and simulate real-world performance, such as courier durability testing [2]. Furthermore, AI is increasingly recognized as a critical enabler for sustainable packaging design, assisting in material optimization, life-cycle analysis, and the development of biodegradable solutions [6]. Specifically, AI-driven green innovation can promote a multifaceted strategy for sustainability, integrating operational efficiency and waste reduction [7]. For engineering students, this exposure is crucial for understanding the future of product development, where AI-driven simulation and optimization will be standard practice. The project's requirement for students to use AI for "research, concepting, asset generation, iteration, and analytics" directly aligns with this literature, positioning AI as an end-to-end workflow component [5].

AI in Marketing and Content Creation Education

In marketing, AI is transforming content strategy, personalization, and campaign execution. The case study's focus on a TikTok marketing campaign is particularly relevant, as short-form video content is highly amenable to AI-driven tools for scripting (e.g., ChatGPT), music generation (e.g., Suno.ai), and video editing (e.g., CapCut AI) [3]. Educational objectives in this domain must move beyond simple tool usage to encompass strategic application and KPI-ready planning, as mandated by the project's assessment criteria. Furthermore, literature emphasizes the need for students to develop robust prompting skills and a strong ethical awareness regarding intellectual property and bias in AI-generated content [4].

Awareness, Perception, and AI Literacy

The mandatory nature of AI integration in this project provides a unique opportunity to study these dimensions, moving beyond voluntary adoption to observe engagement under a required curriculum structure. This study adopts a framework centered on three key dimensions of AI literacy as in Table 1.0:

Table 1.0: Key dimensions of AI

Dimension	Definition in Case Study Context	Measurement Proxy in Project
Awareness	Knowledge of the existence, function, and range of AI tools applicable to the project's design and marketing tasks.	Explicit listing of AI tools used (e.g., Midjourney, ChatGPT, Suno.ai) and documentation of their specific application in the workflow.
Perception (Efficiency)	Students' subjective evaluation of how AI impacted the speed, quality, and effort required for project completion.	Self-reported feedback on time saved, quality of AI-generated assets, and ease of iteration.
Perception (Creativity & Ethics)	Students' views on AI's role in augmenting or hindering their creative output, and their understanding of ethical use (e.g., originality, attribution).	Assessment of "AI use: strategic, ethical, documented" in the final report and analysis of the originality of the AI-generated jingle and video concept.

Case Study Methodology

The case study is situated within the Packaging Design and Technology course, a final-year subject for engineering students. The project was conducted over five weeks by teams of 3-4 students. The project's core challenge was to design a sustainable, courier-durable chip package and market it via a TikTok campaign.

3.1 Survey Instrument and Sample

A total of 25 students, representing approximately 6-8 project teams, participated in the survey. The instrument utilized a 5-point Likert scale (1=Strongly Disagree, 5=Strongly Agree) to measure the three dimensions of AI

literacy established in the theoretical framework (Table 2.0). Then, the standard reliability coefficient formula, Cronbach's alpha is used as follows:

$$\alpha_T = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k} \sigma_i^2}{\sigma^2}\right)$$

Where:

k= number of items on the scale

σ_i^2= variance of each individual item

σ_T^2= variance of the total score (sum of all items for each respondent)

Table 2.0: Suggested Survey Questions (N=25)

Dimension	Question
Awareness	Q1: I was aware of most of the AI tools suggested in the project brief (e.g., Midjourney, Suno.ai) before this project.
	Q2: The project significantly increased my knowledge of AI tools relevant to packaging design and marketing.
Perception (Efficiency)	Q3: Using AI tools significantly reduced the time required for ideation and content creation.
	Q4: AI tools helped me achieve a higher quality of work than I could have achieved without them.
Perception (Creativity & Ethics)	Q5: AI tools augmented my creativity rather than replacing it.
	Q6: I am confident in my ability to use AI tools ethically and responsibly.

Mandatory AI Integration

The project brief explicitly defined the scope of AI use, transforming the project into a quasi-experimental setting for AI integration. The key AI requirements as in Table 3.0. This structured approach ensures that all students, regardless of prior experience, were compelled to engage with a diverse set of AI tools, providing rich data on their awareness and perception.

Table 3.0: Key AI requirements

Project Stage	AI Application Requirement	Example Tools Cited in Brief
Ideation & Concept	Leverage AI for research and early visual ideas for packaging shapes or materials.	Midjourney, DALL·E, Perplexity
Graphic Design	Use AI to generate logo and color options, followed by manual refinement.	AI Logo/Color Generators
Marketing Campaign	Use AI for scripting, music/jingle creation, and video editing.	ChatGPT, Suno.ai/Udio, CapCut AI/Runway
Assessment	Final report must address "AI use: strategic, ethical, documented."	N/A

RESULTS

Initial analysis confirmed a high baseline awareness of AI tools in packaging design, with 96.0% of respondents indicating they had heard of them. The survey findings are summarized in Table 4.0, based on the mean scores of the Likert-scale items.

The results show a clear pattern of strong agreement across most items (Mean average 4.0), with the highest scores indicating a positive impact on Understanding (4.24), Creativity Benefit (4.20), and Ease of Integration (4.20). This strongly supports the hypothesis that mandatory, structured AI integration is an effective pedagogical tool and is perceived by students as a major boost to workflow speed and practical utility.

The lowest mean score across all items is for the statement "AI-generated designs should be disclosed to clients" (Mean=3.80, 60% agreement). This score, while above the neutral point of 3.0, is notably lower than the other agreement rates, suggesting that ethical norms regarding transparency in the design process are still forming.

Table 4.0: Survey Results (Mean Score on 5-point Likert Scale, N=25)

Stages	Survey Item (Abbreviated)	Mean	% Agree/ Strongly Agree
Pre-Project Attitudes	Creativity benefit	4.20	84%
	Job disruption	3.92	68%
	Career readiness	4.00	84%
	Copyright concerns	4.12	84%
In-Class Experience	Efficiency	4.12	84%
	Creative influence	4.04	88%
	Human–AI balance	4.08	80%
	Effective use	4.00	72%
Post-Project Reflection	Understanding improved	4.24	88%
	Creativity enhanced	3.92	84%
	Ease of integration	4.20	88%
	Future confidence	4.04	88%
Ethical Concern	Transparency practice	3.80	60%

Reliability Analysis

Reliability analysis indicates that both composite scales derived from the survey exhibit strong internal consistency. The in-class experience scale (four items capturing effective use, workflow efficiency, positive creative influence, and human–AI balance) achieved Cronbach's $\alpha = 0.919$, which is commonly interpreted as excellent reliability. The post project attitude scale (four items capturing improved understanding, creativity enhancement, ease of integration, and future confidence) yielded Cronbach's $\alpha = 0.827$, indicating good reliability. These coefficients suggest that the items within each composite are measuring the same underlying construct with minimal random errors, and that the resulting composite scores are suitable for use in inferential analyses and for reporting summary statistics.

Table 5.0: Reliability Results (Cronbach's α)

Coefficients group	Cronbach's α
Experience	0.919
Post-attitude	0.827

Results of the open-ended responses

The results in Table 6.0 of the open-ended responses (qualitative findings) from the survey (which remain relevant to the themes of the new quantitative data) provide rich context, revealing three dominant themes:

Table 6.0: Qualitative Findings

Dominant themes	Findings
AI as a Co-Pilot, not a Replacement	Students consistently framed AI as a supportive tool for the initial, iterative phases of design. Students want AI taught as co-creative support, emphasizing skills (prompting, evaluation) and fundamentals of design rather than substitution. This aligns with the high mean score for Creative Influence (4.04) and Human-AI Balance (4.08).
The Necessity of Human Refinement	Most students used AI to accelerate ideation (logos/colors/layout options) but insisted final creative decisions came from human refinement. A minority worried about erosion of critical thinking if over-relying on AI outputs. While acknowledging the speed of AI-generated assets, students emphasized the need for manual refinement. This suggests that the value of the designer shifts from pure creation to curation, refinement, and critical application of AI outputs.
Future Role: Critical Thinking and Curation	The project altered the students' view of their future roles, shifting the focus from technical execution to higher-order skills. Students anticipate a shift to human-led orchestration, with AI as accelerator; they highlight the need to guard quality and sustain human judgment. This is supported by the high agreement on Career Readiness (4.00) and Future Confidence (4.04).

DISCUSSION

The findings provide compelling evidence for the pedagogical value of mandatory AI integration in design and engineering curricula. However, the comparatively lower score for transparency practices (Mean = 3.80) highlights a critical area for improvement. While students readily adopt AI for efficiency and creativity, ethical documentation and disclosure remain uncertain. This reflects broader industry debates on intellectual property and transparency in AI-assisted creative work.

Pedagogical stance: AI as a co-creative partner

Across recommendations, students consistently frame AI as a supportive, co-creative tool rather than a replacement. This suggests coursework should prioritize prompt literacy, output evaluation, and design fundamentals (color, typography, composition), positioning AI as an ideation catalyst while reinforcing human judgment for convergence and finalization. The quotes emphasize teaching that keeps creativity with the student, with AI handling breadth and speed. This aligns with your quantitative findings where efficiency and creative influence show high agreement (≥84–88%), indicating that hands-on AI use reinforces positive, practical views of AI in design. There for, Modules should combine prompting strategies, critique sessions of AI outputs, and manual refinement labs to reinforce creativity and critical judgment

Process integration: AI speed for exploration, human for decisions

Students describe a clear process demarcation: AI for rapid exploration (logos, palettes, layouts) and human refinement for better fit, nuance, and brand logic. They stress that the final design requires manual adjustments to meet project goals and user needs. A minority voice warns that over-reliance can blunt critical thinking. From survey, post-project "ease of integration" and confidence are high (means ≈4.20 and 4.04), while disclosure agreement (60%) is comparatively lower, signaling emerging professional norms about transparency. Thus, educators should teach a two-stage pipeline, one use AI for divergence, and human refinement for convergence.

Meanwhile embedding rubrics that assess refinement quality, rationale, and transparency.

Professional identity: human leadership in an AI-driven industry

Open-ended reflections show students envision their future selves as directors of AI, not competitors. They emphasize critical thinking, problem-solving, and quality assurance as distinctly human strengths, with AI automating repetitive tasks. Notably, job-threat and copyright concern did not correlate with experience, suggesting these are ambient risk perceptions rather than outcomes of classroom experience. Implication is that curricula should prepare students for hybrid roles that combine creative direction, ethical evaluation, and client communication.

Quality & ethics: guardrails for disclosure and originality

Although students see AI as enhancing efficiency and creativity, several comments caution about quality and critical thinking erosion. Given the lower consensus on client disclosure, curricula should explicitly address when/how to disclose AI use, copyright implications, and originality checks (e.g., similarity reviews, source auditing). Embedding ethical checkpoints at key milestones (concept selection, refinement, final delivery) can normalize these practices and reduce ambiguity.

CONCLUSION

This study demonstrates that structured, mandatory AI integration in project-based learning enhances students' awareness, efficiency, creativity, and confidence in packaging design and marketing. Reliability analyses confirm the robustness of the measurement instruments, supporting the validity of findings. Importantly, while students perceive AI as a valuable co-creative partner, ethical norms regarding transparency remain underdeveloped.

To prepare students for AI-driven industries, curricula must move beyond theoretical discussions and embed project-based learning that mandates strategic and ethical use of diverse AI tools. Such approaches transform students into critical, AI-literate professionals capable of leveraging technology to address complex challenges in design, engineering, and marketing.

RECOMMENDATIONS

This study highlights the need to position Artificial Intelligence as a co-creative partner in design education. Educators should emphasize prompt literacy, evaluation of AI outputs, and manual refinement, ensuring that students develop both technical proficiency and critical creative judgment.

AI integration should follow a two-stage pipeline: rapid exploration through AI tools, followed by human refinement to ensure brand fit, usability, and ethical standards. This approach balances efficiency with originality and critical thinking.

Professional identity training must be prioritized. Students should be trained to lead AI systems through critical thinking, ethical evaluation, and disclosure practices, preparing them to articulate the unique value of human creativity in client-facing contexts.

Quality and ethics should be embedded throughout the curriculum. Originality checks, copyright awareness, and transparency norms must be normalized through workshops and assessment rubrics that explicitly evaluate refinement quality, justification of design decisions, and documentation of AI use.

Finally, practical modules such as prompting labs, critique sessions, and client-simulation exercises should be incorporated. Future research should employ advanced measurement techniques to strengthen the generalizability of findings across cohorts and semesters.

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