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ENHANCING EMI ECONOMICS INSTRUCTION IN ASIA: STUDENT PERCEPTIONS OF AI-GENERATED VISUALS FOR COMPREHENSION AND ENGAGEMENT

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Abstract

The rapid global expansion of English-Medium Instruction (EMI) programs has introduced significant pedagogical challenges, particularly concerning student comprehension and engagement in conceptually demanding subjects. In response, this study investigates the effectiveness of integrating AI-generated visual aids into lecture slides to mitigate cognitive load and enhance learning outcomes in an undergraduate EMI Economics course. To evaluate this intervention, a structured questionnaire was administered to 54 Asian first-year students enrolled in a banking and finance program. The findings reveal a highly positive consensus: students overwhelmingly perceive that customized, content-relevant AI visuals significantly improve their understanding, knowledge retention, interest, motivation, and sustained attention during complex explanations. While both genders reported high satisfaction, male participants rated comprehension and retention items slightly higher, potentially reflecting differing spatial-visual processing preferences. This study addresses a critical gap by expanding the literature on visual learning beyond ESL/EFL contexts into rigorous EMI environments. The results advocate for the systematic incorporation of aesthetically refined, contextually aligned AI imagery to optimize instructional efficacy and elevate the student learning experience.

Keywords: English-Medium Instruction, AI-Generated Visual Aids, Economics Education, Student Engagement, Cognitive Load Optimization

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Introduction

The growing popularity of English-Medium Instruction (EMI) programs worldwide, including in Taiwan, has introduced multifaceted challenges for both students and instructors. Pursuing a degree in a non-native language often imposes a significant cognitive burden, particularly when learners encounter unfamiliar professional terminology. This linguistic challenge is frequently compounded by the ubiquity of smartphones and social media platforms, which continuously compete for students' attention in unrestricted classroom environments. Consequently, EMI lectures in academically rigorous disciplines often struggle to sustain student focus, a problem exacerbated when native-speaking instructors maintain a rapid instructional pace. To mitigate these issues and redirect attention toward the core academic content, educators are increasingly leveraging visual aids during lectures. Specifically, Islam and Salam (2023) found significant positive effects of using visual learning materials in non-formal primary classrooms, highlighting their potential to re-engage learners and enhance comprehension.

In response to these pedagogical hurdles, the integration of artificial intelligence (AI) presents a novel opportunity to create customized, highly relevant instructional imagery tailored to learners' needs. Furthermore, Amarin and Al-Saleh (2020) demonstrated that the strategic use of color in instructional materials significantly helps learners grasp abstract concepts and relationships while positively influencing the emotional experiences of both students and teachers. Building on these insights, this study utilized an AI text-to-image generation platform, "Dan Xiaohu," to design conceptually aligned and pedagogically meaningful visuals for a first-year EMI Economics course. By generating contextually appropriate images—such as depicting a man distracted by work emails during a dinner date to illustrate the concept of "opportunity cost"—abstract economic theories were translated into relatable, everyday experiences, thereby enhancing emotional engagement. These visually stimulating elements were strategically embedded alongside concise textual explanations and key economic graphs to encourage cognitive association, deliberately avoiding unnecessary decorative elements to maintain strict academic rigor and relevance.

While a substantial body of literature examines the use of audio-visual and multimedia resources for English as a Second Language (ESL) and English as a Foreign Language (EFL) learners, there is a distinct lack of research exploring how AI-generated visuals can optimize cognitive load and comprehension in demanding EMI environments. This paper fills a critical gap by investigating the effectiveness of AI-generated images in clarifying concepts in an academically rigorous EMI Economics course. Consequently, the primary objective of this study is to explore students' perceptions regarding the customized AI-generated images integrated into their PowerPoint slides. Specifically, this investigation seeks to address three interrelated research questions: (1) how students perceive the effectiveness of incorporating AI-generated images into PowerPoint slides in enhancing their understanding of economic topics; (2) whether students believe that the use of these visuals enhances the knowledge retention of complex economic concepts; and (3) how the integration of such imagery affects students' overall attention, interest, and motivation during lectures.

Literature Review

Theoretical Foundations of Visual Aids in Language Learning

The theoretical foundations of language learning have evolved through various pedagogical approaches, drawing heavily on cognitive science and educational psychology. These foundations provide a robust explanation for the effectiveness of visual aids in information processing and meaning-making across sensory modalities. Driven by academic internationalization, educational institutions worldwide have rapidly adopted English-Medium Instruction (EMI). However, this diversity across languages and cultural contexts poses

significant challenges for curriculum and course design (Wilkinson, 2012). In the current institutional environment, EMI learners face a range of linguistic and academic hurdles. Consequently, researchers continue to investigate the effects of cognitive overload, emphasizing the necessity for the systematic—rather than superficial—integration of visual elements. Historically, Kinder (1950) defined visual aids as instruments that enhance the learning experience by making it more real, accurate, and active.

Paivio's (1990) Dual Coding Theory emphasizes that humans process visual and auditory information through distinct cognitive channels, enhancing comprehension through dual engagement. By selecting relevant information, organizing it, and integrating the verbal/auditory and visual/spatial channels, this dual processing supports cognitive resource optimization and experiential knowledge (Mayer, 2005). Furthermore, Cognitive Load Theory helps explain how visual aids can optimize these cognitive resources by distributing information processing across multiple memory systems (Qasserras, 2024). Poor instructional design requires intense mental effort, creating an unnecessary cognitive burden for EMI learners. Consequently, researchers have focused on schema building—organizing new information into meaningful patterns—to facilitate retention. Several studies also reference Edgar Dale's hierarchy of learning experiences, which suggests that visual symbols, motion graphics, and the progressive disclosure of abstract interactive elements are strategic applications for meeting language-processing demands and fostering academic success.

The multimodal discourse analysis framework further demonstrates the effectiveness of visual aids in modern language learning by recognizing language as one component of a complex system that includes visuals, audio, gestures, and interactive elements. This integration creates immersive learning environments that connect language to real-life contexts. Nafiah (2023) noted that this perspective aligns well with EMI learners, who process academic content and language simultaneously and can reduce their cognitive load by taking these alternative pathways. Additionally, according to Qassrawi et al. (2024), the natural approach to language learning indicates that visual aids, such as movies, create optimal conditions for both language acquisition and content learning in EMI environments. When instructional input is slightly above the learners' current proficiency level, understanding new content becomes challenging; the natural approach mitigates this by emphasizing contextual clues and silent processing via diagrams and infographics.

The addition of graphics to text has consistently been shown to affect reading comprehension positively (Guo et al., 2020). However, instructional animations have demonstrated even stronger effects on learning outcomes than static pictures, supporting contemporary theories of cognitive load and multimedia learning (Berney & Bétrancourt, 2016; Höffler & Leutner, 2007; Noetel et al., 2021). Moreover, Beege et al. (2023) reviewed the impact of an instructor's on-screen presence in videos and found that it enhanced motivational ratings. They concluded that the instructor's visual presence not only shortened the time learners spent focusing on critical visual content but also reduced their perceived extraneous cognitive load. Similar results were corroborated by Polat (2023), who further emphasized the need for additional research to explore the instructor's specific role across various multimedia learning environments.

Empirical Evidence of Learning Outcomes and Student Engagement

A multitude of experimental studies, large-scale surveys, and mixed-method research confirm the positive outcomes of visual aids across diverse age groups, education levels, and cultural contexts. While the theoretical foundations of visual learning have strong empirical support, ongoing technological advancements necessitate further, more focused research on EMI learners. For instance, an examination of Libyan instructors' perceptions regarding audio-visual aids highlighted their benefits in clarifying complex concepts, increasing participation and motivation, and elevating the overall learning experience (Haroony, 2023). Similarly, a large-scale study by Kanwal et al. (2021) across Pakistani universities reported a positive response

to the implementation of audio-visual aids, noting that these tools facilitate deeper understanding, save learning time, and create an engaging classroom environment, even though they cannot fully replace oral and written materials.

Experimental studies further validate these perceptions. Sunder (2018) found statistically significant differences between the experimental and control groups, indicating that audio-visual aids substantially improve learning effectiveness when applied efficiently. Moreover, Qassrawi et al. (2024) studied Palestinian EFL students and observed improvements in speaking performance—specifically in vocabulary acquisition, fluency, and pronunciation—attributed to the use of movies. Concesal and Roslaini (2024) uncovered parallel findings regarding YouTube videos for English-speaking practice, reporting highly positive student perceptions alongside significant increases in enthusiasm, flexible access, and reduced classroom boredom.

While multimedia tools like videos tend to maximize engagement, static images remain widely and effectively used to boost comprehension. Badalova (2021) demonstrated that multimedia learning achieves 80-85% mastery—and visual/audio materials achieve 20% mastery—compared to a mere 5% effectiveness associated with traditional methods. Positive results were also reported by Mohammed (2024), who concluded that visual aids stimulate creative thinking and enhance knowledge retention, fostering high student interest. Schoenherr et al. (2024) demonstrated lasting learning effects across math topics and age groups through visualization interventions. Similarly, Numonova (2024) found that integrating visual aids and graphic organizers into ESL instruction led to an 18% increase in word recall and a 12% improvement in grammar usage, as students actively processed visual stimuli and were more engaged.

Despite these benefits, the effective implementation of visual aids is not without hurdles. According to Islam and Salam (2023), while visual learning materials positively impact motivation, active participation, comprehension, and critical thinking, educators still face infrastructural challenges, insufficient training, and time constraints in material preparation. Consequently, the quality of visual aids is a paramount factor in realizing their positive effects. Cuenca et al. (2024) identified a significant positive relationship between student engagement and the quality of visual aids, echoing the recommendation of Islam and Salam (2023) for enhanced teacher training programs and quality standards to equip instructors effectively.

In the digital era, technological integration frameworks offer immense opportunities but demand considerable effort, investment, and technical support. As Tsui (2023) highlighted, greater teacher-student engagement in EMI contexts fosters openness and more effective learning, especially when instructors create empathetic spaces that acknowledge the inherent challenges of EMI classrooms. Incorporating AI-generated images into presentation slides directly builds upon this notion of engagement by enhancing comprehension and bridging communicative gaps. Although the benefits of visual aids are well-documented, the vast majority of existing literature centers on EFL or ESL environments, paying insufficient attention to the unique cultural and cognitive demands of EMI settings. This study directly addresses this significant gap by examining the use of AI-generated images to optimize economic knowledge acquisition in a rigorous, first-year EMI Economics course, moving beyond the traditional focus on general motivation to assess tangible impacts on academic comprehension.

Methodology

Participants and Ethical Considerations

Students from the first-year Economics class were asked to voluntarily complete a questionnaire concerning the effectiveness of visual imagery in PowerPoint slides. The participants in this study were all students enrolled in the English-taught Banking and Finance program at Tamkang University in Taiwan. The sampling method is purposive, with self-

selection, as students voluntarily participated in this questionnaire. All participants were English as a Medium of Instruction (EMI) learners whose first language is not English. A total of 54 students opted to participate in this study. The potential for self-selection bias arises from the small sample size and the non-random selection. Participants who volunteered for this study may hold stronger opinions about the use of images in PowerPoint slides, thereby reducing the study's generalizability. Careful and thorough measures were taken to protect the rights of participants who opted to complete the questionnaire. Furthermore, all participants were informed about the purpose of the research and how their responses would be used. Therefore, their participation in this study was entirely voluntary, with consent obtained by completing the questionnaire. Additionally, to ensure anonymity, no personally identifying information was collected, and all individual responses were kept confidential. All of the aforementioned steps were implemented to respect the privacy of every participant and uphold ethical research practices.

Data Collection Instruments

A structured questionnaire was developed to gather data for the study. To elicit both demographic information and participants' perceptions of the use of visual imagery in PowerPoint slides during lectures, the questionnaire comprised two sections: demographic background and attitudinal responses. The section on perceptions of visual aids contained 10 closed-ended statements. These statements measured students' perceptions of the effectiveness of images embedded in PowerPoint presentations. The statements were each rated on a five-point Likert scale, ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). These items included in the questionnaire were used to evaluate cognitive, affective, and motivational responses to visual content. Moreover, the perceived impact on understanding, engagement, attention, memory retention, and learning preferences was evaluated. Additionally, to supplement the quantitative data, an open-ended question was included at the end of the questionnaire. The participants were invited to provide additional feedback, comments, or suggestions regarding the images used in the PowerPoint slides. They were also invited to comment on how the instructor integrated them into the lecture and any other elements of the teaching approach that enhanced their comprehension. Subsequently, the combination of quantitative and qualitative items enabled a more detailed understanding of learners' experiences, perceptions, and preferences in an EMI environment.

Data Analysis Procedures

Descriptive statistics, including means and standard deviations, were calculated for all Likert-scale items in the sample as a whole and by gender. Furthermore, inferential analyses were conducted using an independent samples t-test to examine whether participants showed statistically significant differences in their responses by gender. Moreover, in order to further analyze students' open-ended feedback, the study employed thematic analysis. The use of this approach allowed for a thorough assessment of students' perceptions of images in PowerPoint slides and their impact on comprehension, knowledge retention, and engagement.

Findings and Discussion

Demographic Profile and Scale Reliability

Table 1 outlines the demographic profile of the participants ($n=54$). The majority of the students were between 17 and 20 years old (94%), with a small minority aged 21 to 24 (6%). The gender composition indicated a higher proportion of females (59%) compared to males (41%). Regarding self-reported English proficiency, over half of the respondents identified as intermediate (52%), followed by advanced (26%), basic (19%), and native-like proficiency (4%). Prior to examining the perceptual outcomes, the internal consistency of the 10-item scale measuring attitudes toward visual-based learning was assessed. The results demonstrated excellent reliability, yielding a Cronbach's alpha of $\alpha = .92$.

Table 1 Profile of Respondents

Indicators	Frequency (n = 54)	Percentage
1) Age (in years)		
17-20	51	94
21-24	3	6
25 or older	0	0
2) Gender		
Male	22	41
Female	32	59
3) English Level		
Basic	10	19
Intermediate	28	52
Advanced	14	26
Like a native speaker	2	4

Quantitative Perceptions of AI-Generated Visuals

The descriptive statistics presented in Table 2 indicate an overwhelmingly positive perception of integrating AI-generated images into PowerPoint slides. The mean scores across the 10 items ranged from 4.30 to 4.46 on a 5-point scale, with standard deviations reflecting strong consensus (SD = 0.57 to 0.79). Notably, the highest-rated items included: "The images helped me understand the topic more easily" (M = 4.46, SD = 0.57), "The images helped me remember the main ideas" (M = 4.46, SD = 0.66), and "I prefer slides with images rather than only text" (M = 4.46, SD = 0.66). These findings provide robust evidence that conceptually aligned visual aids play a critical role in enhancing comprehension, retention, and overall learner preference in demanding EMI presentations. Furthermore, these results corroborate the earlier assertions by Badalova (2021) and Mohammed (2024), who highlighted the profound effectiveness of visual aids in stimulating creative thinking and improving mastery over traditional instructional methods.

Table 2 Descriptive Statistics of the Students' Attitudes and Preferences Towards the Use of Images

Question Items	Mean	Std. Deviation
1) The images helped me understand the topic more easily.	4.46	0.57
2) The pictures made the class more interesting for me.	4.44	0.66
3) I paid more attention when there were pictures on the slides.	4.30	0.79
4) The images helped me remember the main ideas.	4.46	0.66
5) I prefer slides with images rather than only text.	4.46	0.66
6) The images helped explain difficult or new concepts.	4.41	0.63
7) The pictures were easy to understand.	4.44	0.60
8) I think using more pictures would help me learn better in this class.	4.31	0.75
9) I feel more motivated to learn when visuals are used during lectures.	4.30	0.72
10) The pictures used in the slides were suitable and made sense for the topic.	4.43	0.57

Gender-Based Analysis of Visual Efficacy

Table 3 compares the attitudes toward the use of images between male and female students. Both genders exhibited highly positive responses, with all mean scores exceeding 4.2.

However, male participants generally rated items related to understanding and knowledge retention slightly higher than their female counterparts. Specifically, males reported a mean of 4.59 for the statement that images facilitated easier comprehension, compared to 4.38 for females. A plausible explanation for this slight divergence is the tendency for males to exhibit higher spatial-visual processing preferences (Höffler & Leutner, 2011), aligning with historical literature suggesting that males often demonstrate an advantage in spatial tasks (Reilly & Neumann, 2013). Despite these minor variations, an independent-samples t-test confirmed that none of the differences between genders were statistically significant ($p > 0.05$ for all items). Consequently, the data indicate universal agreement among students on the effectiveness of AI-generated visuals, aligning closely with the findings of Islam and Salam (2023), who found that visual learning materials universally impact motivation, active participation, and comprehension.

Table 3 Descriptive Statistics of Male and Female Students' Attitudes Toward the Use of Images

Question Items	Female (n = 32) M (SD)	Male (n = 22) M (SD)	p- value
1) The images helped me understand the topic more easily.	4.38 (0.55)	4.59 (0.59)	0.1763
2) The pictures made the class more interesting for me.	4.47 (0.62)	4.41 (0.73)	0.7488
3) I paid more attention when there were pictures on the slides.	4.28 (0.73)	4.32 (0.89)	0.8682
4) The images helped me remember the main ideas.	4.38 (0.66)	4.59 (0.67)	0.2446
5) I prefer slides with images rather than only text.	4.41 (0.67)	4.55 (0.67)	0.4549
6) The images helped explain difficult or new concepts.	4.31 (0.59)	4.55 (0.67)	0.1844
7) The pictures were easy to understand.	4.34 (0.6)	4.59 (0.59)	0.1410
8) I think using more pictures would help me learn better in this class.	4.25 (0.72)	4.41 (0.8)	0.4477
9) I feel more motivated to learn when visuals are used during lectures.	4.31 (0.64)	4.27 (0.83)	0.8435
10) The pictures used in the slides were suitable and made sense for the topic.	4.34 (0.55)	4.55 (0.6)	0.2041

Note: M = Mean; SD = Standard Deviation.

Thematic Analysis of Student Feedback

To provide a deeper, qualitative context to the statistical data, a thematic analysis of the open-ended survey responses was conducted. The feedback was systematically categorized into three overarching themes: comprehension enhancement, knowledge retention, and sustained engagement.

First, regarding comprehension and understanding, students consistently reported that the AI-generated images effectively visualized complex economic concepts and supported self-study outside the classroom. For instance, self-identified visual learners emphasized that the images "made it easier to understand the materials," functioning as a crucial scaffold when reviewing textbooks independently. Students noted that the visuals, particularly when interactively paired

with the professor's explanations, significantly reduced the cognitive burden of the abstract subject matter.

Second, the theme of knowledge retention emerged strongly. Participants highlighted that integrating visual diagrams and real-life scenarios into data-heavy topics—such as analyzing charts and economic trends—clarified relationships that would have been exceedingly difficult to grasp from text alone. By actively referencing the images and encouraging discussion, the instructor ensured the visuals felt purposeful rather than merely decorative, enabling students to "better connect theory with practice" and retain the content more firmly.

Finally, the images played a pivotal role in boosting attention, interest, and motivation. Students reported that the visually rich slides transformed traditionally dense lectures into an engaging and motivating experience. The customized images helped learners "develop a story or a logical argument about the topic," thereby capturing their attention at critical moments during complex explanations.

Overall, the thematic feedback substantiates the quantitative data. While academic staff often face demanding workloads that limit the time available for designing visually engaging instructional materials, the compelling positive responses from EMI learners underscore the immense pedagogical value of systematically incorporating AI-generated images into lecture presentations, regardless of students' varying levels of English proficiency.

Conclusion

While the existing literature extensively documents the benefits of audio-visuals and multimedia in EFL and ESL programs, this study bridges a critical gap by evaluating the perceived effectiveness of AI-generated images for EMI learners navigating the rigorous cognitive demands of university-level Economics. The findings reveal a highly positive consensus: students overwhelmingly believe that conceptually aligned AI visuals significantly enhance their understanding, knowledge retention, interest, motivation, and sustained attention during complex theoretical explanations. Although both male and female participants shared these positive views, males generally rated items regarding comprehension and retention slightly higher, potentially reflecting established differences in spatial-visual processing preferences. Ultimately, this study strongly advocates for the systematic incorporation of customized AI imagery as a strategic pedagogical tool to optimize instructional efficacy and reduce cognitive load in demanding EMI environments.

Despite these promising results, certain limitations must be acknowledged. Primarily, the relatively small sample size of 54 participants restricts the statistical power required to detect more subtle demographic trends or differences in students' perceptions. Additionally, the reliance on purposive sampling introduces a potential self-selection bias, as students who volunteered may inherently possess stronger opinions or higher engagement levels regarding visual learning. Consequently, these methodological constraints may limit the broader generalizability of the current findings.

Although this investigation was confined to a single Economics course, its outcomes establish a robust foundation for future scholarly inquiry. To validate and expand upon these initial findings, future research should investigate the integration of AI-generated visuals across a wider array of academic disciplines and diverse cultural contexts beyond Taiwan and Asia. Such comparative studies are essential for thoroughly assessing the cross-cultural applicability of these pedagogical strategies and establishing generalized best practices for EMI programs globally.

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Data Availability Statement: The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

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Appendix: Survey Instrument

Part A: Demographic Information

This section collected basic background information from the participants.

1. **Age:** (Categories: 17-20 / 21-24 / 25 or older)
2. **Gender:** (Categories: Male / Female / Other)
3. **Current Major:** (e.g., Banking and Finance)
4. **First Language (Mother Tongue):** (e.g., English, Malay, Chinese, Japanese, Bahasa Indonesia, Vietnamese, Tamil, Other)
5. **Self-Reported English Proficiency Level:** (Categories: Basic / Intermediate / Advanced / Native-like)

Part B: Perceptions of AI-Generated Images

Participants were asked to rate the following 10 statements based on a 5-point Likert scale: 1 (Strongly Disagree), 2 (Disagree), 3 (Neutral), 4 (Agree), and 5 (Strongly Agree).

1. The images helped me understand the topic more easily.
2. The pictures made the class more interesting for me.
3. I paid more attention when there were pictures on the slides.
4. The images helped me remember the main ideas.
5. I prefer slides with images rather than only text.
6. The images helped explain difficult or new concepts.
7. The pictures were easy to understand.
8. I think using more pictures would help me learn better in this class.
9. I feel more motivated to learn when visuals are used during lectures.
10. The pictures used in the slides were suitable and made sense for the topic.

Part C: Open-Ended Feedback

Participants were provided with an open text box and asked to respond to the following prompt:

- "Please share any comments or suggestions about the images used in the PowerPoint slides, how the professor used them during class, or anything about the professor's teaching style that helped your understanding."