Exploring Students' Perceptions of AI-Supported Infographic and Comic-Based Instruction for Teaching Principles of Economics

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ABSTRACT

Students often perceive introductory economics as abstract and cognitively demanding, particularly at the diploma and vocational levels where learning motivation may be limited. Therefore, this exploratory study examines students' perceptions of AI-supported infographic and comic-based instruction for teaching Principles of Economics, supported by AI-assisted tools for content simplification and the development of instructional materials delivered through an e-learning platform. A pre-experimental post-intervention-only design was employed involving 30 Malaysian vocational college diploma students. Data were collected using a structured questionnaire measuring students' perceived conceptual understanding, learning motivation, learning interest, and perceived usefulness. Descriptive statistics and Pearson correlation analysis were employed to examine response patterns and relationships among the constructs. The findings indicate that students reported moderate to positive perceived conceptual understanding, alongside high levels of learning motivation, interest, and perceived usefulness after engaging with the instructional materials. These results provide preliminary pedagogical insights into the potential role of AI-supported multimodal instruction as a scaffold for enhancing student engagement in the teaching of abstract economic concepts. Implications for instructional design and future research are discussed.

Introduction

The teaching and learning of fundamentals of economics is considered as a problematic field within educational research. Core economic concepts such as scarcity, opportunity cost and types of economies are abstract ideas that students find difficult to understand (Sunny et al., 2024). This problem is exemplified in vocational education where learners often have differing academic backgrounds and learning to read may not be motivating or engaging for them (Canut-Montalva et al., 2025). Consequently, students might become demotivated and lose sustained interest in learning economics, consequently having difficulties advancing to higher order-activities of analysis such as supply-and-demand modelling (Noguera et al., 2024).

To address these challenges, the educational technology literature has been paying attention to multimodal instructional methods which fuse visual and narrative features. Infographics and comic-format curriculum materials support external representation of complex ideas, leading to reduced cognitive load and deeper learning (Mayer, 2020; Chiu et al., 2023). Moreover, the application of artificial intelligence (AI) in content simplification and customisation has been identified as a promising trend in addressing learners' engagement and understanding (Fortuna et al., 2025). For instance, AI-enabled tools that create summaries, visualizations, and personalized pathways can make content more accessible, especially to learners who might be less familiar with academic language (Wang et al., 2024).

Despite increasing interest in AI-supported and multi-modal learning methods, there is a lack of empirical studies investigating their combination applied to introductory economics, particularly in the context of vocational colleges. Although previous research has investigated the use of infographics and comic narratives in other educational areas,

such as science (Abdul Wahid & Abdul Wahid, 2025) or language learning (Maniteze et al., 2025), a paucity of evidence exists concerning how these tools impact students' conceptual understanding of economics, motivation to learn economics and interest about economic content. This gap is pertinent because vocational students' experiences with basic economics may influence their future interest in both academic and real-life economic matters (Cai & Kosaka, 2024). Moreover, the distinct learning requirements and pragmatic orientations of vocational learners highlight the necessity to scaffold instruction in their context (Abdul Aziz et al., 2023).

This study contributes novel empirical insights by focusing on vocational college students, a learner group that has received relatively limited attention in existing research on AI-supported instructional approaches. By situating the study within the context of vocational economics education, it extends current teaching and learning research beyond the higher education setting that is more commonly examined. In addition, the study presents a novel pedagogical approach that combines infographic-based visual representation and comic-based narrative elements, with AI used primarily to support instructional material development rather than to replace instructor-led teaching. Collectively, these contributions offer practical pedagogical insights for teaching abstract subjects in mixed-ability vocational classrooms.

In most of the Malaysian VCs, instruction not only in economics but also other disciplines are conducted through formal lectures and there has been emphasis on auditory-based teaching with less or no active or visual learning elements taking place which could result in continuing issue of engagement among students (Adnan & Rahman, 2024). Anecdotal feedback from instructors indicates that students often perceive introductory economics as theoretical and irrelevant to their program of study in technology, accounting for poor class attendance and learning outcomes. This is consistent with the international literature, which suggests that basic economic content is commonly misunderstood if taught in a traditional manner (Arthur et al., 2025). On this basis, new pedagogical methods must be developed to promote the deep learning of economics by the vocational students.

This study aims to provide preliminary empirical insights into students' perceptions of AI-supported infographic and comic-based instruction in the teaching of Principles of Economics within a vocational college context. Specifically, it examines students' perceived conceptual understanding, learning motivation, learning interest, and perceived usefulness after exposure to the instructional intervention. Given the limited existing research combining AI-supported multimodal strategies in vocational economics education, this study is positioned as an exploratory investigation intended to generate initial evidence and inform future large-scale research. Accordingly, the findings should be interpreted cautiously as indicative rather than conclusive evidence of instructional effectiveness.

Therefore, it is expected that by analysing the perceived conceptual comprehension of students after learning from AI-supported infographic and comic-based instruction, the learning motivation and interest upon completion of teachers' instructional intervention as well as the interrelationships among conceptual understanding, learning motivation, learning interest, and perceived usefulness in context of this study can be further understood.

Research Objectives

This study was guided by the following research objectives:
1. To examine students' perceived conceptual understanding after exposure to AI-supported infographic and comic-based instruction.
2. To examine students' learning motivation following the instructional intervention.
3. To examine students' learning interest after the intervention.
4. To examine students' perceived usefulness of the AI-supported instructional approach.
5. To examine the relationships among conceptual understanding, learning motivation, learning interest, and perceived usefulness.

Literature Review

Challenges in Learning Introductory Economics

Introductory economics is notorious for being difficult; it requires learners to think like economists. Foundational economic concepts, such as scarcity, opportunity cost and economic systems are abstract and systemic in nature and can be challenging for students to understand when their learning experience is based on learning from written explanations and symbols (Lin & Bates, 2022). It is interesting to note that the empirical studies reveal that students find it difficult to build coherent mental models of these basic concepts leading to fragmented knowledge and residual misconceptions that bar them from learning at a deeper level (Arthur et al., 2025).

If anything, the problems are compounded in vocational education where students are generally more heterogeneous (academically speaking) and where learners themselves expect a focus on practical, skill-oriented rather than theoretical learning. Research studies conducted in science and vocational-technological colleges show that economics is often regarded as separable from students' vocational training resulting in lower engagement, motivation, and cognitive involvement into foundational concepts learning (Noguera et al., 2024). This is further complicated by the fact that conventional lecturer-based pedagogies continue to be the main approach in many of our vocational colleges, including those in Malaysia, which tend to emphasise content coverage more than understanding concepts and activeness among learners (Adnan & Rahman, 2024). As a result, students might employ shallow memorisation techniques that hinder their learning experience as well as self-assurance in and readiness for higher-level economics subjects.

Conceptual Understanding in Economics Learning

Conceptual Understanding is one of the main learning objectives in economics education, because it is considered as the ability to comprehend economic issues and become able to apply economic reasoning and decisions making. The weak conceptual knowledge at introductory levels is viewed as one of the factors that contribute to student learning difficulties in higher level topics (e.g. market equilibrium and macroeconomic analysis) and therefore highlights the need to reinforce students' concept basis for successful learning transitioning (Cai & Kosaka, 2024). Meaningful learning: Cognitive psychology place significant emphasis on instructional design that will help learners to construct accurate mental models. The theory of multimedia learning articulates that information processing is more efficient for learners when information is presented via verbal and visual channels, because doing so diminishes cognitive overload and encourages deeper conceptual processing, especially in abstract domains like economics (Mayer, 2020).

Research in different educational settings has consistently shown a positive effect of visual-based and multimodal learning materials on conceptual learning. Research in business and technical education has shown that digital textbooks, which are able to visually represent information for students, can increase learning scores and knowledge acquisition significantly, also underlining the importance of visually structured materials in applied/technical studies (Nurlaela et al., 2025). Elsewhere, in distance and higher education, infographics resources contribute to learners' understanding of an abstract domain subject matter such as business by facilitating their comprehension of threshold concepts (Kamarudin et al., 2025). Evidence from inclusive education also demonstrates that visually rich and feedback focused multimedia learning designs such as activity-based on infographics improve conceptual understanding, engagement and retention of knowledge among different learners (Akrami & Shirvani, 2025). In line with such findings, infographics improved understanding and recall of content by putting information into a structured and visually accessible format (Teo et al., 2025). In economics education, visual representations are generally believed to facilitate students' comprehension of complex systems and trade-offs; thus, they would be especially powerful in presenting basic concepts for vocational learners (Cai & Kosaka, 2024).

Learning Motivation in Multimodal and Visual Instruction

Motivation for learning is an important factor that students are engaged in, continue with learning activities and ultimately achievement. It affects the way learners approach tasks, apply effort and respond to setbacks. In the field of economics education, low motivation has often been associated with students' views of economics as something challenging, impersonal and lacking relevancy to their lives – three points which can undermine both continued engagement and deep understanding (Maniteze et al., 2025). Empirical evidence on vocational economics education also shows that student-centred instructional models, like team-based flipped learning approach, significantly improve both the learning achievement and motivation as compared with traditional didactic teaching model (Lai et al., 2020).

These results emphasize the importance of active learning designs that allow learners to assert more control over their studies.

It is a well-documented fact that mixed modality in educational design, combining visual and interactive elements, has a beneficial effect on learners' motivation. The use of visually rich media can captivate the learners, help to lower learning-anxiety and increase attention (Saltan & Arslan, 2017), students' perceived competence therefore levitating intrinsic motivation and commitment even for cognitively challenging matter (Abdul Aziz et al., 2023). This sort of motivational support is especially important in vocational education settings, where students may come from very broad educational backgrounds and have different levels of confidence. Studies reveal that instructional designs using infographics and visual narratives make the learning situation more favourable, students feel more confident and actively participate in learning activities (Noguera et al., 2024). Hence, visually oriented and multimodal didactic concepts might be a promising approach to overcome motivational barriers and changing for the better learner attitudes towards economics.

Learning Interest and Comic-Based Instruction

Interest in learning is the "persistent disposition to engage particular kinds of content over time" and is related to motivation and longer-term educational goals. Long-term motivation is crucial for keeping students' attention beyond their currently perceived instructional needs. Nevertheless, in economics education infrequent interest has been reported and instructional practices do not make abstract ideas contextualized in real experiences that can be comprehended by students which provoke a superficial learning (Arthur et al., 2025). In response to this challenge, we need teaching strategies that attract students' attention and explain economic ideas in real-world settings that reflect something of the way our students' lives work.

Narrative-based teaching methods such as comic-based learning have therefore drawn more and more attention because storytelling and context are promising for stimulating interest in learning. Comics intertwine images and text, promoting students to connect academic content to everyday experiences and real-life situations, thus humanising abstract ideas as well as increasing interest (Abdul Wahid & Abdul Wahid, 2025). The research also consistently shows positive results regarding student engagement, curiosity and interest following comic-based instruction. read its educational comics have been used, supported by structured learning support, based on which Topkaya et al. (2023) concludes that it significantly enhances motivation and knowledge acquisition for pupils in a variety of subjects. Also, Maniteze et al. (2025) found that the use of comic-based learning resources enhanced students' interest in a topic and increased their positive attitudes towards learning in equal measure more than when traditional means were employed. Within the context of vocational education, where practical and contextual forms of learning are particularly appealing, comic-based instruction is also a promising technique of generating interest in economics among students.

Artificial Intelligence–Supported Instructional Design

Artificial intelligence (AI) has become a transformative technology in education, which introduces new opportunities for improving instruction design and learning experience. AI aided tools can help educators to simplify complex material, design visuals and produce multimodal learning resources adapted to students' needs, of interest in abstract disciplines as economics that need thoughtful conceptual scaffolding (Fortuna et al., 2025). TE has many years experience of research on AI in ED. Studies investigating the contribution of an AI-aided tutorial design have been able to show that if combined with sound pedagogical concepts, it can make a positive impact on cognitive and affective learning outcomes. In accordance with this point of view, Chiu et al. (2023) argued that AI should also work as a pedagogical scaffold instead of a substitute for teaching, to help learners to develop their understanding and enhance engagement by delivering adaptive content in multimodal format.

There is empirical and qualitative evidence for the pedagogical benefits of AI-supported multimodal learning designs. Research has shown that AI-infused learning environments, which also include infographics and other visual supports, can increase student engagement, intrinsic motivation, and reflection on learning when anchored in pedagogically sound theories (Aydın Yıldız, 2025). Considering online teacher education, evidence is found signifying that web-based digital resources especially visual–infographic design applications and artificial intelligence are commonly viewed effective in improving learning efficiency, motivation, and sustainable learning (Avcı & Subaşıoğlu, 2025).

Recent empirical evidence has also underscored that AI-scaffolded multimodal learning environments have the potential to enhance students' conceptual understanding, motivation and engagement in a variety of educational settings (Wang et al., 2024). Consistent with the preceding evidence, cutting-edge AI systems that combine mega language models with long-standing analytic methods demonstrate how semantic analysis can buttress traditional instructional content to a greater extent confirming AI as a helpful crutch to support learning (Monsalves et al., 2026). As a whole, these studies indicate that AI-supported instructional design especially in the context of applied infographics and narrative-based material integration practices is promising as a means to address long-standing challenges in economics education, such as those found in coding-focused schools with distinctive learner demographics.

Methods

Research Design

A pre-experimental post-intervention-only design was employed to investigate the influence of AI-mediated infographics and comics on students' conceptual understanding, learning motivation, and learning interest in the Principles of Economics. A quantitative approach was considered appropriate as the study aimed to quantify students' learning responses using structured instruments and statistical analysis, thereby enabling systematic examination of trends across multiple variables (Edmonds & Kennedy, 2017).

The study focused on post-intervention measurements collected after students were exposed to the instructional materials. Such a design is commonly adopted in educational research to examine learners' perceptions and learning outcomes following the implementation of instructional innovations (Fraenkel & Wallen, 2019). The intervention was conducted during the teaching of Chapter 1 (Introduction to Economics), which introduces fundamental economic concepts and serves as a conceptual foundation for subsequent topics.

This study employed a pre-experimental post-intervention-only design to capture students' perceptions immediately after exposure to the AI-supported instructional materials. This design was selected to align with the exploratory nature of the study, which sought to examine learners' cognitive and affective responses to a newly implemented instructional approach rather than to establish causal effects.

In this study, artificial intelligence (AI) tools were employed as a pedagogical scaffold to support instructional material development rather than as autonomous instructional agents. Specifically, AI-assisted tools were used to facilitate content simplification, support the design of visual infographics, and assist in generating narrative elements for comic-based instructional materials. Instructional sequencing, facilitation, and learning activities were designed and conducted by the instructor to ensure alignment with course objectives and learner needs.

Samples and Population / Participants

The target population of the study comprised diploma students enrolled in Principles of Economics at Malaysian vocational colleges. The sample was drawn from three vocational colleges in Penang, Malaysia, three public vocational colleges in Penang, Malaysia, hereafter referred to as College A, College B, and College C to ensure institutional anonymity.

A purposive sampling approach was also used given that participants had to share the participation in an instruction program with the purpose of contributing to a group whose state had undergone change following their participations (Etikan et al., 2016). The last sample consisted of business-related program students who received the learning content covered in AI-supported infographic and comic-based materials. Demographic analysis showed that the sample was representative of a typical vocational college in relation to gender, mean age and former contact with economics.

Given the exploratory nature of this study and the implementation of a specific instructional intervention, purposive sampling was deemed appropriate to ensure that all participants had direct exposure to the AI-supported infographic and comic-based instructional materials. As this study represents a preliminary investigation conducted within

naturally existing classroom groups, probability sampling was not feasible. Therefore, the findings are intended to provide contextualised insights rather than broad generalisations to the wider vocational student population.

Research Instruments

Data were gathered through a structured self-administered questionnaire to assess students' perceptions of the instructional strategy. The instrument was developed based on existing theoretical models and previous empirical research in multimedia learning, motivation, academic interest and educational technology acceptance.

The questionnaire was divided into 5 parts. Section A collected demographic information. Section B assessed conceptual understanding, based on instruments (derived from multimedia learning and conceptual change literature) that emphasize the perceived clarity, confidence, and explanatory proficiency of learners for concepts taught by instructors (Mayer, 2020; Lin & Bates, 2022). Part C: motivation of the student for learning, with items based on the principles of motivational theories—attention (A), relevance or confidence (R), and effort (E) adapted form ARCS Motivation Model by Keller (2010) and Maniteze et al. (2025). Section D focused on learning interest, based on interest development theory emphasizing enjoyment, curiosity and the readiness to invest effort in a topic (Hidi & Renninger, 2006; Arthur et al., 2025). Section E quantified usefulness perception, drawn from the Technology Acceptance Model (TAM), which is highly used in educational technology research to measure students' perceptions of instructional tools (Davis, 1989; Wang et al., 2024).

All perception items were rated on a 5-point Likert scale from 1 = Strongly Disagree to 5 = Strongly Agree, which is in line with typical practices for educational research (Joshi et al., 2015). For content validity of the questions, the questionnaire items were reviewed by experts in economics education and educational technology. There was a satisfactory level of internal consistency for all the constructs as Cronbach's alpha coefficients for each construct were greater than the 0.70 level, recommended by Nunnally and Bernstein (1994).

Instrument Reliability

The internal consistency of the measurement scales was examined using Cronbach's alpha to ensure the psychometric adequacy of the instrument prior to inferential analyses. Cronbach's alpha (α) coefficients were computed for each attribute, namely Conceptual Understanding, Learning Motivation, Learning Interest and Perceived Usefulness. Table 1 shows that each construct exhibits acceptable reliability, with Cronbach's alpha values exceeding the cut-off point recommended in the literature (Nunnally & Bernstein, 1994).

In particular, the internal consistency of Conceptual Understanding proved to be high (α =. 881), thereby revealing that the items were measuring construct consistently. Learning Interest (α =. 874) and Perceived Usefulness (α =. 858) also demonstrated strong reliability. Reliability Acceptable internal consistency for Motivation to Learn was demonstrated (α =. 771), indicating the consistency of measurements on students' motivational responses. These findings indicate that the instrument employed in our study is both reliable and appropriate for inferential analysis.

Table 1
Reliability Analysis of Research Constructs (n = 30)

Construct	Number of items	Cronbach's α
Conceptual Understanding (CU)	5	0.881
Learning Motivation (LM)	5	0.771
Learning Interest (LI)	5	0.874
Perceived Usefulness (PU)	5	0.858

Note. Cronbach's alpha values ≥ .70 indicate acceptable internal consistency.

AI-mediated Infographics and Comics

In this study, the instructional intervention involved the integration of AI-assisted infographic design and comic-based narrative materials to support the teaching of introductory economic concepts. The intervention was implemented during the delivery of Chapter 1 (Introduction to Economics) in the Principles of Economics course across three vocational colleges in Penang. The aim was to transform abstract economic ideas into visually structured and contextually meaningful learning materials that could better support vocational students with diverse academic backgrounds.

The instructional materials were developed by the instructor with the assistance of artificial intelligence tools. AI was used to simplify complex textual explanations and generate concise summaries that informed the design of infographic materials highlighting key economic concepts such as scarcity, opportunity cost, and economic resources. The infographics presented information through icons, diagrams, and short explanatory texts, allowing students to process information through both visual and verbal channels while reducing cognitive overload.

To further contextualise the concepts, comic-based narratives were incorporated to illustrate everyday decision-making situations related to economic choices. Short comic panels depicted familiar scenarios such as choosing between limited resources or evaluating trade-offs in daily life. The use of visual characters, dialogue, and sequential storytelling helped present abstract economic ideas in a more relatable and engaging format.

The intervention was conducted during a teaching session for Chapter 1. Students were first introduced to the infographic materials that summarised key economic concepts, followed by guided explanations and discussions facilitated by the instructor. Subsequently, comic-based scenarios were used to stimulate discussion and encourage students to connect theoretical concepts with practical situations. In this study, AI functioned primarily as a design support tool that assisted in preparing instructional materials, while the instructor remained responsible for guiding the learning process.

Data Analysis

Data were analysed with statistical package for social science (SPSS). Frequencies, percentages, means and standard deviations were conducted as descriptive statistics to characterize students' demographic information and general-overall response of the constructs. Those analyses gave an indication of how students reacted to the AI-infused infographic and comic approach.

Reliability analysis was performed to check the internal consistency of the measurement scales before performing inferential statistics. Reliability analyses were performed for each scale and a value of 0.70 or higher was considered as acceptable (Nunnally & Bernstein, 1994).

Inferential analysis, on the other hand, was directed toward investigating the relationships between the main variables. The internal consistency of the constructs were verified first by reliability analysis. A Pearson correlation analysis was employed to investigate the relationships of conceptual understanding, learning motivation, learning interest and perceived usefulness. Where applicable, analyses of means were done to explore response trends between institutions. All statistical analyses were conducted at $p < .05$, following common practice in educational research (Field, 2018).

Results

Demographic Profile of Respondents

An overall number of 30 Malaysian diploma students in Penang vocational colleges were involved in the study. The sample consisted of male and female students and females were predominant in number. All participants were studying in a vocational program and completed at least instructional materials with AI-supported infographics and comics. The demographic profiles suggest that the sample is indeed representative of the typical vocational college population in terms of diversity of academic backgrounds and limited previous exposure to economics.

Table 2
Summary of Respondents' Demographics (n = 30)

Response	Frequency (n)	Percentage (%)
Gender		
Male	6	20.0
Female	24	80.0
Vocational College		
College A	14	46.7
College B	10	33.3
College C	6	20.0

Descriptive Results for Conceptual Understanding

The descriptive statistics for conceptual understanding are provided in Table 3. The mean overall scores represent a moderate to moderately high level of understanding for students after using the materials.

The highest mean values were scored for items related to clarity for comprehension of fundamental economic concepts (M = 3.67, SD = 1.09) and abstract phenomena supported in visual comic format understanding (M = 3.60, SD = 1.07). Scores were somewhat lower among confidence in explaining opportunity cost and economic resources (M = 3.40, SD =0.89) and to answer Chapter 1 questions (M = 3.37, SD=0.96). These results imply that the methods of instruction were conducive to students' understanding of fundamental economic principles, although some students may need further practice in order to develop sufficient mastery for a deeper understanding of this concept.

Table 3
Descriptive Statistics for Conceptual Understanding (n = 30)

Item Description	Mean (M)	SD
I understand the basic concepts of economics more clearly after using the infographic and comic-based learning materials.	3.67	1.09
The infographic and comic-based materials help me understand economic problems such as scarcity and choice.	3.57	0.94
I am more confident in explaining the concept of opportunity cost and economic resources.	3.40	0.89
The use of visual elements and comics makes abstract economic concepts easier to understand.	3.60	1.07
I feel more confident answering questions related to Chapter 1 of Principles of Economics.	3.37	0.96

Descriptive Results for Learning Motivation

The descriptive statistics of the learning motives are presented in Table 4. The results show high mean scores in all motivation items.

Students indicated that they were also encouraged to engage in learning activities with the infographic and comic-based materials (M = 3.83, SD = 1.09). High mean levels of increased confidence in learning economics (M = 3.80, SD = 0.92) and willingness to spend more effort on the subject (M = 3.80, SD = 0.76) were also recorded. These results indicate that the teaching experience was successful in increasing student motivation and decreasing affective barriers to learning economics.

Table 4
Descriptive Statistics for Learning Motivation (n = 30)

Item Description	Mean (M)	SD
The infographic and comic-based learning materials attract my attention during the learning process.	3.83	1.09
I feel more motivated to learn economics after using the infographic and comic-based materials.	3.73	0.87

Learning economics becomes less stressful when using the infographic and comic-based approach.	3.77	0.77
This learning approach increases my confidence in learning economics.	3.80	0.92
I am willing to put more effort into learning economics after using these materials.	3.80	0.76

Descriptive Results for Learning Interest

The descriptive statistics for learning interest are found in Table 5. High level of interest among the students is evidenced by results obtained after exposure to instructional materials.

The highest mean scores were found for items concerning whether the comic and infographic-based instruction method made learning fun (M = 4.00, SD = 0.83) and students would want to use this method for other economic topics (M = 4.00, SD = 0.83). There was also a high level of interest in more economics topics (M = 3.80, SD = 0.81). These results suggest that the instructional method was effective in developing favourable interest and liking of learning introductory economics.

Table 5
Descriptive Statistics for Learning Interest (n = 30)

Item Description	Mean (M)	SD
Learning economics becomes more interesting when using infographic and comic-based materials.	3.97	0.72
I enjoy learning Chapter 1 of Principles of Economics using this approach.	3.57	0.90
I am interested in learning more economics topics after this learning experience.	3.80	0.81
The combination of infographics and comics makes the learning process more enjoyable.	4.00	0.83
I would like this learning approach to be used for other topics in economics.	4.00	0.83

Descriptive Results for Perceived Usefulness

Descriptive statistics for perceived usefulness are presented in Table 6. In general, students found the teaching method very helpful to understanding economics.

The highest mean score was obtained in the item of whether it is applicable to other subjects (M = 4.10/ SD = 0.71), followed by the compatibility of the materials with diploma-level students (M = 4.03, SD = 0.76). Students also agreed that the materials helped them to learn economics- (M = 3.97, SD = 0.76) and had value as memory aids (M = 3.70, SD= 0.65). These results indicate the high level of acceptance by students of this teaching model and its potential application outside economics.

Table 6
Descriptive Statistics for Perceived Usefulness (n = 30)

Item Description	Mean (M)	SD
The infographic and comic-based learning materials are useful for learning economics.	3.97	0.76
This learning approach helps me remember economic concepts more effectively.	3.70	0.65
The infographic and comic-based materials are suitable for diploma-level students.	4.03	0.76
This learning approach meets my learning needs in understanding economics.	3.77	0.73

This learning approach should be applied in other subjects besides economics.	4.10	0.71

Correlation Analysis

Pearson's correlation analysis was used to analyse the relationships between conceptual understanding, learning motivation, learning interest and perceived usefulness. Mean scores were calculated for each construct before analysis. The correlation analysis between PCC and psychometric scores is shown in Table 7.

The results showed that conceptual understanding and learning motivation were positively related at a moderate level (r =. 465), suggesting that respondents' self-reported understanding of economics was, on average, strongly associated with their expressed motivation for learning it. Conceptual understanding exhibited weaker positive correlations with learning interest (r =. 238) along with perceived usefulness (r =. 299), perhaps indicating that comprehension is not alone the best predictor of affective learning outcomes.

Positive and significant correlations could be found between learning motivation and learning interest (r =. 764), and also between learning motivation and perceived usefulness (r =. 793). Likewise, learning interest had significant positive correlation with perceived usefulness (r =. 833). This is an indication that both motivational and affective constructs are highly related and contribute heavily in determining how students view the approach to instruction.

Table 7
Pearson Correlation Matrix among Research Variables (n = 30)

Construct	CU	LM	LI	PU
Conceptual Understanding (CU)	1.00	0.47	0.24	0.30
Learning Motivation (LM)	0.47	1.00	0.76	0.79
Learning Interest (LI)	0.24	0.76	1.00	0.83
Perceived Usefulness (PU)	0.30	0.79	0.83	1.00

Note. Correlation coefficients are Pearson's r. All correlations are positive.
p < .05.

Discussions

This discussion is organised according to the stated research objectives. RO1 examined students perceived conceptual understanding, RO2 and RO3 focused on learning motivation and learning interest, RO4 examined perceived usefulness, and RO5 investigated the relationships among these constructs. As this study was positioned as an exploratory investigation with a small purposive sample, the findings are interpreted as preliminary and context-specific rather than conclusive evidence of instructional effectiveness.

The findings indicate that students reported moderate to moderately high levels of perceived conceptual understanding after exposure to the AI-supported infographic and comic-based instructional materials. These results suggest that the integration of visual representations and narrative elements may have supported students in clarifying abstract economic concepts such as scarcity and opportunity cost. This aligns with multimedia learning theory, which posits that combining visual and verbal channels can facilitate the construction of coherent mental models while reducing cognitive overload (Mayer, 2020).

However, the moderate mean scores on confidence-related items suggest that while students perceived improved clarity, deeper mastery may require sustained exposure beyond a single instructional unit. Introductory economic concepts often demand repeated engagement and application before full conceptual consolidation occurs. Therefore, although the instructional design appears promising in scaffolding initial understanding, the findings should be interpreted cautiously as reflecting students' perceptions rather than objective learning gains.

Within the vocational education context, where learners may have diverse academic backgrounds and varying prior exposure to economics, visually structured and narrative-supported materials may serve as an accessible entry point into abstract subject matter. Nevertheless, further studies employing performance-based assessments or experimental designs would be required to determine whether such perceived understanding translates into measurable conceptual achievement.

The results also demonstrate relatively high levels of reported learning motivation following the instructional intervention. Students indicated increased attention, confidence, and willingness to invest effort in learning economics after engaging with the infographic and comic-based materials. These findings are consistent with the ARCS motivational framework, which emphasises attention, relevance, confidence, and satisfaction as key drivers of learner engagement (Keller, 2010).

The visual and narrative elements embedded in the instructional materials may have reduced perceived difficulty and learning anxiety often associated with economics. In vocational settings, where students may prioritise practical or applied learning, instructional strategies that increase perceived accessibility and relevance are particularly important. The multimodal design likely enhanced students' sense of competence, thereby contributing to increased motivational responses.

Nevertheless, given the self-reported nature of the data, the results reflect perceived motivation rather than observed behavioural engagement. While the preliminary findings suggest that AI-supported multimodal instruction may positively influence affective dimensions of learning, further research employing longitudinal or behavioural measures would strengthen understanding of sustained motivational effects.

Students reported high levels of learning interest after exposure to the instructional materials, particularly regarding enjoyment and willingness to apply the approach to other economic topics. These findings suggest that the integration of comic-based storytelling with infographic structures may have stimulated situational interest, making abstract economic content more relatable and engaging.

Narrative-based instructional strategies have been shown to contextualise academic content in ways that resonate with learners' lived experiences. In vocational education, where contextual and applied learning is often valued, comic-based representations may humanise economic principles and facilitate emotional engagement with the subject matter. The relatively high mean scores for enjoyment and continued interest indicate that the instructional design may have contributed positively to students' affective orientation towards economics.

However, interest development is a gradual process. While the findings indicate strong situational interest, it remains uncertain whether this would evolve into long-term individual interest without sustained instructional reinforcement. Therefore, the results should be interpreted as preliminary evidence of short-term affective engagement rather than confirmation of durable attitudinal change.

The findings also reveal that students generally perceived the instructional approach as useful and appropriate for diploma-level learning. The highest mean scores were observed for the applicability of the approach to other subjects, suggesting that students recognised the broader instructional value of multimodal and AI-supported materials.

Perceived usefulness is a central construct in the Technology Acceptance Model (Davis, 1989), and it often predicts sustained adoption of instructional innovations. The high ratings indicate that students not only found the materials engaging but also considered them beneficial for understanding and remembering economic concepts. This suggests that the instructional approach may align well with learners' expectations and needs within vocational contexts.

However, perceived usefulness does not necessarily equate to demonstrable effectiveness. The findings represent subjective evaluations and should be interpreted within the exploratory scope of the study. Future research integrating objective academic performance indicators would provide a more comprehensive evaluation of instructional impact.

Next, the correlation analysis revealed moderate relationships between conceptual understanding and learning motivation, and strong relationships among learning motivation, learning interest, and perceived usefulness. These

findings suggest that affective dimensions of learning were closely interconnected in the context of the AI-supported instructional intervention.

The relatively stronger associations among motivation, interest, and usefulness imply that the instructional design may have primarily influenced affective engagement rather than directly enhancing conceptual mastery. This pattern is particularly noteworthy in vocational education, where affective barriers often hinder engagement with theoretically demanding subjects such as economics.

The moderate relationship between perceived conceptual understanding and motivational constructs suggests that while improved clarity may contribute to motivation, affective responses may also be shaped by aesthetic design, contextual relevance, and narrative engagement. As such, AI-supported multimodal instructional design may function primarily as an affective scaffold that enhances engagement, which in turn could serve as a precursor to deeper learning over time.

Given the small sample size and exploratory design, these correlational findings should not be interpreted as evidence of causal relationships. Instead, they provide indicative patterns that warrant further investigation using more rigorous methodological designs and larger samples.

Conclusion

Based on the findings, this study offers the empirical evidence that AI-assisted infographic and comic-based instruction may have a significantly positive effect on students' learning of Principles of Economics, particularly in those at vocational college level. Results show that although students' conceptual understanding achieved only moderate improvement, the levels of motivation to learn, interest and perceived utility in learning were high after their exposure to the instructional materials. These results indicate that when visual and narrative-based pedagogical strategies are used in combination, with the support of AI tools, they can aid attitude engagement and understanding of abstract economic content.

The reliability and correlation tests reinforce the findings of the study, validating not only internals consistency of the measurement instruments but also identifying significant relationships between key learning variables. The close interplay between motivation, interests and the perceived utility of function is not only relevant with respect to vocational learners who find conceptually challenging subjects difficult but, arguably, also regarding those training vocational teachers.

Practically, this study implies that teachers in vocational colleges should utilize computer-aided AI-mediated multimodal instruction to facilitate interesting and accessible learning of the subject economics. Using infographics and comic-style storytelling educators can design learning experiences that support comprehension as well as attitudes promoting acquiring economic knowledge. Consequently, the study is a resource to emerging literature on AI-based pedagogy and offer clear actionable recommendations in vocational education for instructional innovation.

The findings of this study suggest that AI-supported instructional approaches may primarily support affective learning dimensions, particularly students' learning motivation and interest, within the context of vocational economics education. These affective outcomes may serve as important precursors to deeper conceptual understanding, especially when teaching abstract subject matter. In this respect, the study contributes to the existing literature by framing AI not merely as a content-delivery tool, but as an affective and cognitive scaffold that supports instructional design and learner engagement.

Limitations and Future Studies

First, the study employed purposive sampling with a relatively small sample size (n = 30), which limits statistical power and restricts the generalisability of the findings. As participants were drawn from intact classroom groups exposed to a specific instructional intervention, the sample may not fully represent the broader population of vocational students. Consequently, the results should be interpreted as exploratory and context-bound rather than generalisable

across institutions. Future research is encouraged to adopt probability-based sampling strategies and involve larger samples to enhance representativeness, reduce selection bias, and strengthen methodological rigour.

Second, this study relied on self-reported data to examine students' perceived conceptual understanding, learning motivation, and learning interest. While self-report measures provide valuable insights into learners' experiences, they are susceptible to response bias. Future studies may incorporate additional measures of learning outcomes, such as pre- and post-tests or performance-based assessments, to complement perceptual data and provide a more comprehensive evaluation of instructional effectiveness.

Finally, the scope of the study was limited to a single chapter of the Principles of Economics course, and the analysis focused on examining relationships among key learning variables rather than establishing causal effects. Further research could explore the application of visual and narrative-based instructional approaches across multiple topics or over an extended period, using experimental or quasi-experimental designs to generate stronger causal evidence and better inform instructional decision-making in economics education.

Conflict of Interest

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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