Journal of Engineering Science and Technology
Vol. 20, No. 1 (2025) 129 - 150

ENHANCING BRAIN-BASED CREATIVE THINKING IN ECONOMICS THROUGH INTERNET-BASED TEST AND CONSTRUCTIVIST LEARNING

AI NUR SOLIHAT[1,*], DADANG DAHLAN[2], K. KUSNENDI[2], BUDI SUSETYO[2], RADEN RORO SUCI NURDIANTI[1], ASTRI SRIGUSTINI[1]

[1]Universitas Siliwangi, Jl. Siliwangi No 24 Tasikmalaya, Indonesia
[2]Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No 229 Bandung, Indonesia
*Corresponding Author: ainursolihat@unsil.ac.id

Abstract

This study aims to investigate how internet-based tests (IBT), and the constructivism learning model affect students' creative thinking abilities in learning economics. A quasi-experimental method with a pretest-post-test control group design was used, involving grade X high school students. Data were collected through a specially designed creative thinking ability test implemented using an IBT platform. In addition, data collection was also conducted through direct observation and questionnaires given to students. Data processing was carried out by analysing the improvement of students' creative thinking skills through pretest and post-test scores. Data analysis techniques used descriptive analysis, t-tests, and ANOVA to test significant differences between the experimental and control groups. The results showed that students involved in problem-solving learning models and IBT demonstrated a significant improvement in creative thinking ability compared to students who followed conventional learning methods. Students in the experimental group were better able to generate creative ideas, solve problems in innovative ways, and connect economic concepts more effectively. The scientific contributions of this research include the development of a constructivist learning model integrated with internet technology to improve creative thinking skills in economics, as well as emphasizing the importance of training and technological support for teachers to implement learning methods that support the development of student's creative thinking skills. This research adds insight into how the integration of technology and innovative pedagogical approaches can support the development of creative thinking skills, which are highly relevant in modern education.

Keywords: Constructivism, Creative thinking, Economic education, Internet-Based Test (IBT).

1. Introduction

In the world of education, creative thinking processes in learning are increasingly receiving significant attention. The 21st century recognizes creative thinking as an essential skill, with significant demand in various aspects of life and work [1]. The continuous development of the world demands the improvement of human resource capabilities in education, economics, and the arts [2, 3]. Creative thinking includes the ability to generate new ideas, solve problems in inventive ways, and see connections among seemingly unrelated topics [4, 5]. To face the ever-evolving challenges in the professional field and society, every individual needs to have the ability to think creatively and generate new solutions [6]. Engaging in creative thinking during the learning process allows students to not only master the lessons but also develop important skills such as creative thinking, cooperation, and communication that are essential for their future endeavours [4, 7]. Although this creative thinking is seen as important, the learning process often faces obstacles. An inherent problem is the lack of support and understanding provided by conventional educational frameworks, which still prioritize instruction oriented toward concept understanding and learning outcomes [7, 8]. This approach tends to neglect the development of innovative cognitive abilities and is more concerned with measurable academic achievement [9]. In addition, there are also concerns about limited resources and insufficient competence for educators to incorporate innovative teaching methods into the learning process [10]. Teachers in many countries lack the necessary skills to effectively instruct children in creative thinking, resulting in challenges in encouraging the development of these skills [11]. Excessive rigor in the classroom and inadequate time for inquiry pose hurdles to fostering students' creative thinking [12].

Many studies have examined in education to foster creative thinking skills. The incorporation of innovative learning methods that can improve creative thinking skills. Wang and Li [13] showed that learning methods affect brain networks related to creative thinking, such as the default and salience networks, indicating a gap in teacher competence in encouraging creativity in the classroom. Therefore, teachers' use of innovative methods is essential to foster students' creative thinking skills. Gu et al. [14] criticized traditional learning models that focus on academic achievement and evaluation of learning outcomes, often neglecting the development of creative skills. They introduced the use of innovative technologies in creativity courses, suggesting that appropriate learning methods and technology integration can be effective in developing students' creative thinking skills. Sawyer [15] highlighted the important role of teachers in developing creative thinking through classroom interactions, emphasizing that adequate training and support for teachers can enhance creativity in education, even though the education system still focuses on academic achievement. Ritter and Mostert [16] showed that structured learning processes can improve students' ideation skills and cognitive flexibility, which are important in an academic achievement-oriented educational environment. Furthermore, the use of technology in education can support the development of students' creative thinking skills. Research highlights the importance of Science, Technology, Engineering, and Mathematics (STEM) education in developing modern skills for the digital age [17]. The study on grade 9 students showed that the use of digital tools and pedagogical models in a student-centred learning environment significantly improved creative thinking skills. Santer and Fitrianti et al. [18] concluded that innovative constructivism and student-centred learning approaches can effectively improve creative thinking skills in STEM education. Wang and Li [13] and Rosen et al. [19] emphasize the importance of innovative technologies strategies and assessments in a student-centred learning environment is highly effective in enhancing creative thinking skills [20]. Teachers can use digital technology and constructivist pedagogical models to create dynamic and interactive learning environments that improve students' academic achievement as well as their creative thinking skills [21, 22].

Various studies have highlighted the importance of using innovative learning models to develop students' creative thinking skills. While many studies have demonstrated the benefits of innovative learning methods and technologies for improving students' creative thinking skills, there are still some gaps that need to be addressed. Firstly, there is a lack of research exploring the integration of specific technologies in various educational contexts and their impact on brain networks associated with creative thinking. Second, given the role of teachers in developing creative thinking through classroom interaction and training, more research is needed on the design of effective teacher training programs to address competency gaps in promoting creativity in the classroom. Thirdly, the importance of student-centred learning approaches in education is still under-appreciated. Fourth, although the findings show the effectiveness of implementing innovative strategies and assessments, further research is needed to develop holistic and comprehensive assessment tools that assess students' academic achievement and creative thinking skills simultaneously.

This research brings novelty by integrating an internet technology-based student-centred learning model to develop students' creative thinking skills, which has not been explored in depth in the literature. The integration of internet technology in this problem-solving-based learning model is also complemented by a digitally developed and integrated creative thinking test tool, an approach that responds to the need for a comprehensive assessment tool that assesses creative thinking skills as well as academic achievement. This research aims to address the gap in the literature by exploring the effectiveness of a student-centred, problem-solving-based learning model that uses internet technology to develop students' creative thinking skills. In addition, this study aims to develop and test a creative thinking assessment tool integrated with internet technology to provide a more holistic evaluation of students' creative thinking skills and academic achievement. This is in line with the results of Samala and Amanda [23], who found that the use of technology in the learning process has a significant influence on the development of students' thinking skills.

2. Literature review

2.1. Brain-based creative thinking

Figure 1. shows the hemispheres of the human brain. The human brain is a complex organ with separate regions controlling specific cognitive functions, and the hemispheres have a significant impact on different parts of cognition [24, 25]. The brain consists of several components, each of which plays a different role in cognitive function [26]. Aberg et al. [27] mentioned that the cerebral hemispheres consist of the left and right hemispheres. The left hemisphere is typically involved in processing language, words, arithmetic, and equations [28], while the right hemisphere is associated with creativity, imagination, music, and colour processing

[29]. The left brain plays a diverse role in contributing to creativity, involving different regions and mechanisms to facilitate divergent and convergent thinking [30]. Other studies have also mentioned that the left brain contributes to creativity by actively engaging in cognitive processes rather than being in a cortical quiescent state [31]. The left temporal pole, specifically the left temporal pole cortex, contributes to creativity by being involved in the transmission and processing of semantic information [32]. This study found that there is a positive correlation between the global efficiency of an individual's semantic network and the left temporal pole cortex [33]. This region is critical for creative thinking as it mediates the relationship between gray matter volume in the left temporal pole and creative ability [34]. Visually, the information processing in the creative thinking process is shown in Fig. 2.

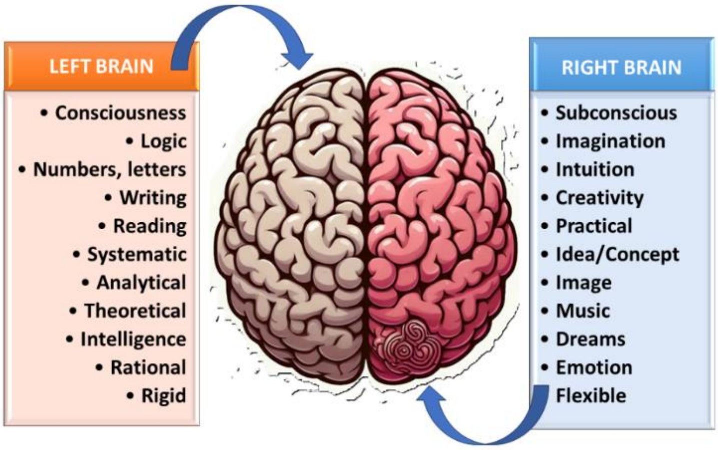

Fig. 1. Human cerebral hemispheres.

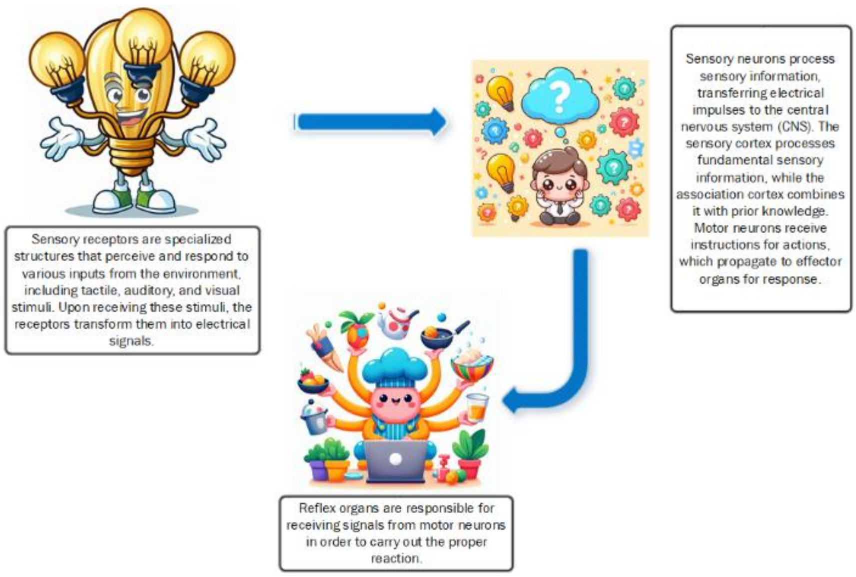

Fig. 2. Information processing in the creative thinking process.

2.2. Constructivism learning model

Constructivism is a philosophical perspective that highlights the idea that knowledge is created by individuals [35]. Constructivism theory focuses on students' interactions with the natural world and their prior knowledge and beliefs [36]. Constructivism learning theory emphasizes the importance of collaboration between students in creating a learning environment that supports the exchange of ideas and diverse perspectives [37]. Through this collaboration, students can broaden their horizons and develop the ability to consider different viewpoints, significantly enriching their learning process [38]. Collaboration between students can also help in honing social skills and the ability to work together, which are important competencies in an increasingly globalized world of work [39]. This is in line with the social constructivist perspective described by Vygotsky, highlighting the role of social interaction in knowledge formation and allowing students to evaluate and refine their understanding through collaborative discourse [40].

The constructivist approach's concept of student-centred learning provides a solid foundation for developing 21st-century skills needed to face future challenges. Learning is a constructive process that incorporates scientific discovery, problem-solving, and production through exploration, experimentation, creativity, perseverance, patience, curiosity, and cooperation [41]. In addition, through active interaction with the subject matter and discussion with fellow students, students' collaboration and communication skills are also honed, preparing them to work in environments that require teamwork and joint problem-solving [42]. Collaboration with individuals who have unique perspectives can stimulate creative thinking and open the door to more holistic and detailed solutions [43]. Through interactions with individuals who have different viewpoints, learners can see problems from multiple perspectives that enrich their understanding and inspire new, more innovative ideas [44]. Learners must be able to construct their information in their cognition. Thus, they can build their knowledge [45]. Harjali [46] suggests three emphases in constructivism learning theory, namely the active role of learners in constructing knowledge meaningfully, and the importance of linking ideas in constructing meaningfully and linking ideas with new information received.

Learning in the context of the constructivist approach is directed towards the process of discovery and problem-solving [47]. Problem-solving learning is based on cognitive psychology, with the assumption that learning is a process of behavioural change through experience. Learning is not simply memorizing things, but rather a deliberate interaction between an individual and their environment. During this process, students will undergo holistic development, encompassing not just cognitive components but also affective and psychomotor aspects, as they internally reflect on the challenges they encounter. [48]. Judging from the philosophical aspect of the function of school as a means to prepare students to live in society, the problem-solving learning model is very important to develop because humans are always faced with problems from simple to complex [49]. The problem-solving learning model is expected to provide practice and the ability for each individual to solve the problems they face [50]. To implement the problem-solving learning model, teachers need to choose subject matter that has problems that can be solved [51].

John Dewey, an American educationist, described six steps of problem-solving learning [44], as shown in Fig. 3.

Fig. 3. The steps of problem-solving.

2.3. Internet Based-Test (IBT)

The integration of Internet technologies into assessment practices has significantly changed the educational landscape, offering both opportunities and challenges. Internet technologies can revolutionize assessment strategies in 21st-century education systems by enabling more dynamic and interactive forms of evaluation that go beyond traditional paper and pencil tests [52]. The use of technology in assessment can enhance formative and summative processes, providing valuable opportunities for learning and feedback [53]. Historically, technology has facilitated assessment since the use of the abacus, but modern advances allow for more sophisticated methods such as computer-based testing, which offers flexibility in scheduling and can accommodate the diverse needs of learners, including those with disabilities [54]. Large-scale testing benefits from technological applications that streamline logistics and introduce rich, authentic tasks that better assess integrated knowledge and critical thinking [55]. Technology-supported assessment, especially in the context of collaborative problem-solving, provides unobtrusive documentation of learner performance and enables dynamic interaction and feedback, which is critical to assessment for learning and assessment as learning [56]. Internet-based e-assessment models are aligned with student-centred learning activities, helping students achieve desired levels of competence through formative assessment approaches [57]. The rapid expansion of internet resources, however, poses challenges in finding and accessing information, highlighting the need for systematic methods to describe and provide access to these resources [58]. Despite these challenges, the potential for ICT to innovate in assessment is vast, offering immersive technologies and virtual performance assessments that provide rich experiences for observing and analysing student performance [59, 60].

The Internet-based test (IBT) can be used to measure various cognitive abilities, including creative thinking skills in learning economics. IBT is easy for students to use. On the homepage, there are menus such as All Courses, Instructors, My Profile, and Start. To start the test, students select the All Courses menu, which displays subjects such as math, science, and economics. Students choose the economics subject and then log in using the username and password that have been created by the teacher. After logging in, students select the relevant subject teacher, and the subject page will appear with menus such as overview, curriculum, and instructors. To carry out the test, students select the overview menu, which presents information about basic competencies, subject matter, question indicators, and the dimensions of creative thinking measured. The questions are randomized by the system, and students can work on them in order or not. The question number button at the bottom will change from a circle to a yellow box after the question is done. After all questions are completed, the student clicks the finish button, and the test score will be displayed. In detail, the flow of using the IBT is shown in Fig. 4.

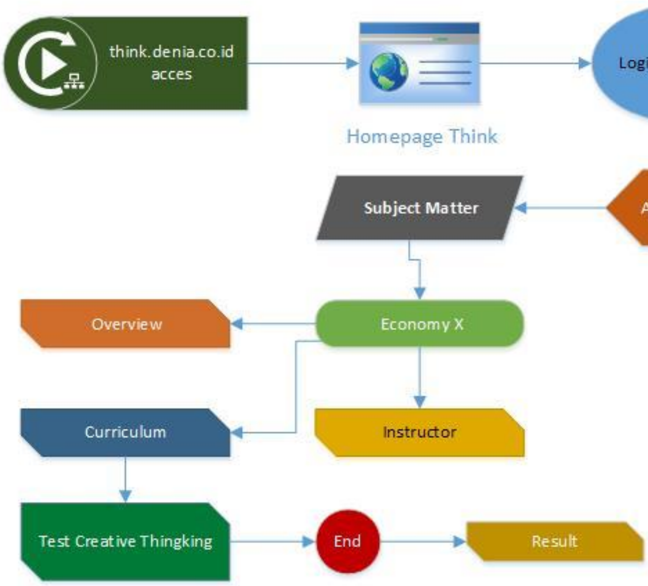

Fig. 4. Flowchart of IBT usage.

2.4. Economic material: Demand, Supply and Market Equilibrium

In the world of education, economics is one of the important subjects to be taught to students. Many reports regarding economics in education have been reported (see Table 1). This is because it relates to everyday life. For example, the terms demand and supply refer to the actions of individuals as they conduct transactions within a market [61]. A market refers to a set of individuals or entities involved in the buying and selling of a particular product or service, where a set of customers determines the demand for a product while a set of sellers determines the supply of the product. The following sub-sections are a detailed explanation of demand, supply, and equilibrium prices.

Table 1. Previous studies on economics in education.

No.	Title	Ref.
1	Theoretical foundations of the restaurant business	[62]
2	Activity-based management	[63]
3	Economic policies for sustainable development: Balancing growth, social equity, and environmental protection	[64]
4	Aspect-based sentiment analysis on product reviews	[65]
5	Economic analysis of yam production under the taungya agroforestry system with cost analysis	[66]
6	Emotional intelligence, job satisfaction, reward system and organizational commitment among workers	[67]
7	The influence of social media endorsement credibility on customers-based brand equity	[68]
8	Improving the use of marketing strategies in the modern logistics system	[69]

No.	Title	Ref.
9	Methods of assessing the efficiency of economic implementation of the level of property capitalization	[70]
10	A conceptual approach to the synthesis of the architecture of information and trading systems	[71]
11	The influence of environmentally friendly packaging on consumer interest in implementing zero waste in the food industry to meet sustainable development goals (SDGs) needs	[72]
12	Money talks, but what about freebies? Understanding the influence of material benefits in politics	[73]
13	Harmonization of international valuation standards and international financial reporting standards.	[74]
14	A review compiled with tax and subsidiary, implication for government, decision-makers, enterprises, community, and analysis cost/benefit and market.	[75]
15	Social entrepreneurship as catalyst for solving socioeconomic problems created by Covid-19 pandemic lockdown	[76]

2.4.1. Demand

In economics, demand refers to the quantity of a product or service that consumers desire at various price levels. Demand analysis is important to understand the relationship between price and the quantity consumers want to buy, which is usually represented by a demand curve [77]. This relationship is influenced by several factors: the price of the good, the price of similar goods, income, preferences, and consumer expectations. Changes in the price of a good directly affect demand; generally, higher prices lead to a decrease in the quantity demanded, while lower prices increase consumer demand [78]. Demand is also affected by the prices of substitutes and complementary goods [79]. An increase in the price of substitutes encourages consumers to switch to them, while an increase in the price of complementary goods tends to decrease demand [80]. Consumer income is another major factor; when income increases, demand for normal goods tends to rise, but demand for inferior goods may decrease [81]. Consumer preferences or tastes also affect demand, with changes in tastes either increasing or decreasing demand [82]. In addition, consumer expectations about the future, such as anticipated price or income changes, can affect current demand [83]. Demand analysis uses the ceteris paribus concept, which assumes that all other factors remain constant, to simplify the study of the relationship between price and quantity demanded [77]. A demand curve that decreases from the top left to the bottom right illustrates the negative correlation between price and quantity demanded, indicating that consumers tend to buy more when prices fall and vice versa [78]. The steps in creating a demand curve involve collecting price and quantity data and plotting these relationships on a graph. Here are the steps in creating a demand curve [78].

(i) Gathering Information: Collect data on various price points and corresponding quantities demanded.

(ii) Compiling a Table: Organize the data in a table, including columns for price and quantity demanded.

(iii) Creating Axes: Create a horizontal (x) axis to represent the quantity demanded, and a vertical (y) axis to represent the price.

(iv) Graph: Create a graph based on the data collected.

(v) Making connections: Connect the dots to form a demand curve.

An illustration of a challenge involving the creation of a curve is shown in Fig. 5.

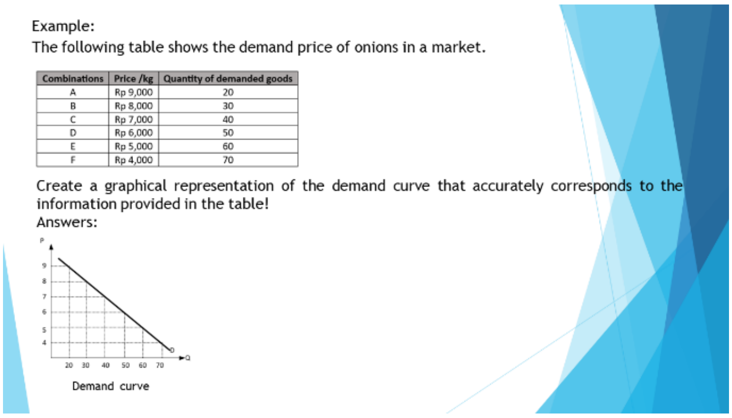

Fig. 5. Simple case to learn how to draw a demand curve.

2.4.2. Supply

In market theory, supply is the amount of goods or services that producers are willing and able to sell at various price levels in a given period. Supply is influenced by factors such as product prices, production costs, technological advances, prices of similar goods, producer predictions, the number of sellers, and government regulations [84]. When the price of goods increases, producers tend to offer more to maximize profits [85]. Conversely, increases in production costs, such as raw materials and labour, reduce producers' ability to provide goods, resulting in lower supply [86]. Technological advances improve production efficiency, allowing producers to increase supply while reducing costs [30]. If the price of a substitute item rises, producers may switch to producing that item as it is more profitable, while an increase in the price of a complementary good may increase the supply of the main good [87]. Predictions of future price increases may also cause producers to hold back current sales to obtain higher prices later. An increased number of producers in the market increases the number of goods available [88]. Government policies such as subsidies, taxes, and regulations can affect production costs and profits, which in turn affect supply. In supply analysis, the concept of ceteris paribus is used to simplify the relationship between price and quantity offered by holding other factors constant [89]. The supply curve, which usually increases from the lower left to the upper right, shows a positive relationship between price and quantity offered [90]. The steps in creating a supply curve involve collecting price and quantity data and plotting these relationships on a graph to illustrate how supply changes with price variations. The following are the steps in creating a supply curve [91].

(i) Information Gathering: Collect data on various price points and corresponding bid amounts.

(ii) Compiling a Table: Organize the data in a table, including columns for price and bid amount.

(iii) Creating Axes: Make a horizontal (x) axis to represent the supply amount and a vertical (y) axis to represent the price.

(iv) Graph: Create a graph based on the data collected.

(v) Making connections: Connect the dots to form a demand curve.

An illustration of a challenge involving the creation of a curve is shown in Fig. 6.

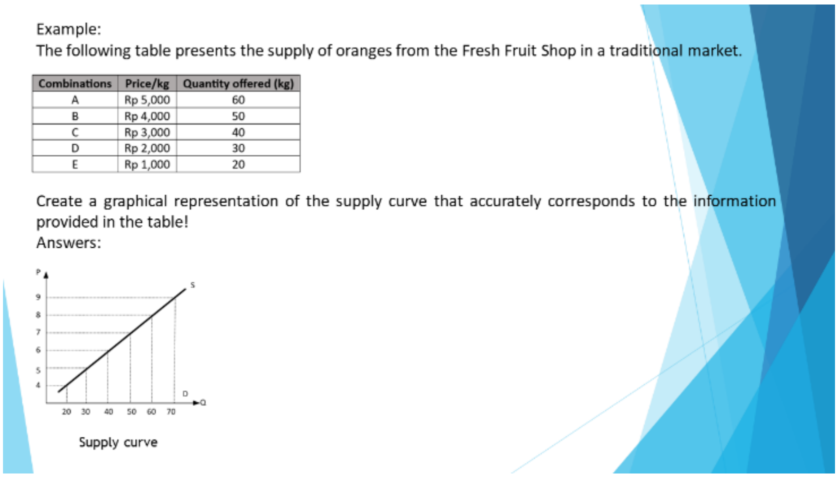

Fig. 6. Simple case to learn how to draw a supply curve.

2.4.3. Market equilibrium

Market price equilibrium occurs when the amount of goods or services demanded by consumers is equal to the amount offered by producers [92]. At this equilibrium point, the market has no impetus for price changes because the forces of demand and supply are balanced [93]. The concept of market price equilibrium involves three main elements: demand, supply, and equilibrium itself [94]. Demand describes the willingness of consumers to purchase goods or services at various price levels [95]. The relationship between price and quantity demanded is negative; that is, when prices rise, the quantity demanded tends to fall, and vice versa [96]. The demand function can be expressed in Eq. (1). In contrast, supply reflects producers' willingness to sell goods or services at various price levels [97]. Its relationship with price is positive, indicating that when prices rise, the quantity of goods offered tends to increase [98]. The supply function can be expressed in Eq. (2).

$$Q_d = f(P) \tag{1}$$

where Q_d is the quantity of goods demanded, P is the price.

$$Q_s = f(P) \tag{2}$$

where Q_s is the quantity of goods offered.

Market equilibrium is achieved when the quantity of a good demanded is equal to the quantity of a good offered [92]. At this point, the equilibrium price and equilibrium quantity can be found by equating the demand function and the supply function [99]. Thus, the equilibrium market price describes a situation where the forces of demand and supply balance each other. Thus, there is no significant pressure for price changes, resulting in market stability [94].

An illustration of a challenge involving the generation of a market equilibrium curve can be observed in Fig. 7.

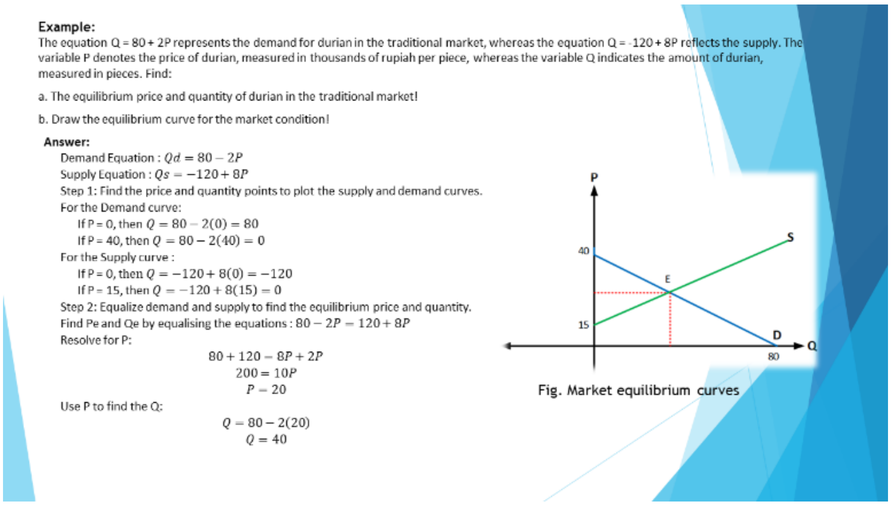

Fig. 7. Simple Case to Learn how to draw a market equilibrium curve.

3.Method

This research utilizes the quasi-experimental method. The quasi-experimental method is very useful in social science research because it can be used to get around practical and ethical problems, it can show complicated things happening in real life, and it can lead to results that are more relevant and useful to many people. This strategy allows us to investigate cause-and-effect relationships, even though they cannot fully manipulate the variables involved. The experiment was conducted for five meetings, where students were given a pretest and post-test using 57 items of creative thinking test instruments in economic learning that were declared feasible and had been integrated with IBT in the first and fifth meetings. In the second to fourth meetings, students were given treatment using the problem-solving learning model.

This experiment was attended by 82 high school X-grade students spread over two classes that served as experimental and control classes. In the experimental class, the learning model used was the problem-solving model, while in the control class, the group discussion method was used. The study followed the applicable research ethics, ensuring that no subject was harmed, and all participation was voluntary. Data were collected through pretests and post-tests, observations during the learning process, and questionnaires to obtain information related to the response to the use of the learning model and creative thinking test instruments integrated with IBT. Data processing techniques involved statistical analysis to compare pretest and post-test results between the two groups to assess the effectiveness of the applied learning model. In detail, the details of the experimental subjects are shown in Table 2.

Table 2. Details of experimental subjects.

No.	Class	Number of Students	Description
1	X7	40	Experiment Class
2	X10	42	Control Class

4. Results and Discussion

Table 3 shows the results of the analysis conducted on the application of the problem-solving model and group discussions. The average pretest and post-test scores in the experimental and control classes were obtained. Detailed information regarding the use of t-tests is explained elsewhere.

Table 3. Average pretest and posttest scores of experimental and control classes.

Class	Number of Students	Average Score		Mean Improvement	N-Gain
		Pretest	Posttest		
Experiment	40	40.4	82.5	42.2	0.71
Control	42	48.3	78.8	30.5	0.58

Table 3 displays the results of data analysis in the experimental and control classes, showing an increase in the average pretest to post-test score of 40.4 in the experimental class with an N-Gain value of 0.71. Similarly, the results of data analysis in the control class showed an increase in the average pretest-to-post-test score of 30.5 with an N-Gain value of 0.58. The N-Gain value in both classes is included in the high category, which indicates that the application of the learning model in both classes is effective in improving students' creative thinking skills. To validate these results, the t-test was used to test the null hypothesis (H_0), which states there is no significant difference between the groups, and the alternative hypothesis (H_1), which states there is a significant difference [60]. The null hypothesis rejection criterion is based on the statistical test's p-value, with the significance level set at $\alpha = 0.05$ [100]. If the p-value is less than 0.05, the null hypothesis is rejected [60]. Hypothesis testing in experimental and control classes was conducted using paired sample t-tests and independent sample t-tests, which showed that the application of the problem-solving-based learning model was effective in improving students' creative thinking skills, as indicated by a p-value (Sig. 2-tailed) of 0.000. The results of this test are visually displayed in Table 4.

Table 4. Experimental and control class hypothesis test results.

Class		Number of students	Average score	t	df	Sig (2-tailed)
Experiment	Pretest	40	40.4	-	39	0.000
	Posttest		82.6	5.514		
Control	Pretest	42	48.3	-	41	0.000
	Posttest		78.8	5.388		

Based on the results of the analysis that has been done, the problem-solving learning model used in this study is proven to be able to improve students' creative thinking skills. This is indicated by an increase from pretest to post-test scores indicated by the N-Gain value in the high category. This means that using the constructivism learning model to implement creative thinking instruments can improve students' creative thinking abilities. Then, the results of hypothesis testing have been carried out using paired sample t-tests and independent sample t-tests. The problem-solving learning model can significantly improve students' creative thinking skills. This is consistent with Gallagher's [101] research, which found that the problem-solving learning model can help students develop their creative thinking skills by promoting various dimensions of creativity.

Problem-solving education is a constructive process that combines scientific discovery, problem-solving, and production through exploration, experimentation, creativity, perseverance, patience, curiosity, and cooperation [35]. Based on the questionnaire responses given to students, this problem-solving model is a learning model that is not boring. Students' responses to the use of the problem-solving learning model in detail are shown in Table 5.

Table 5. Student's response to the implementation of problem-solving learning model.

No.	Statement	Response (%)		
		Strongly agree	Agree	Disagree
1	The teacher teaches in an easy-to-understand manner.	36	60	4
2	The teacher motivates students to be able to understand and master the learning material.	22.7	76	1.3
3	The teacher uses a learning model that is not boring. Teachers use fun test media tools.	33.3	57.3	9.3
4	In group discussions, the teacher gives problems that can explore curiosity about the problem.	33.3	60	6.7
5	In group discussions, the teacher provides intriguing problems. Thus, students are interested in solving them.	32	62.7	5.3
6	The problems given are problems that occur in everyday life.	34.7	60	5.3
7	The teacher assists students in executing the discussion.	44	53.3	6.7
8	Students' learning style motivates them to better understand economic lessons.	17.7	77.3	8

Table 5 provides information that, overall, this data shows that the majority of students feel comfortable and motivated with the learning approach applied by the teacher, which includes easy-to-understand teaching methods, the use of interesting learning models, the relevance of the material to daily life, as well as active guidance in group discussions. This finding is consistent with Chen and Chan's [102] statement that problem-solving focuses on students understanding the basic concepts of a subject, encourages students' active participation in learning, and asserts that real learning occurs through personal exploration.

In the learning process, giving questions to students that contain problems related to everyday life raises curiosity. Thus, students are motivated to find out and find alternatives to solving problems by constructing their solutions to the problems given. As stated by Boud and Feletti [103], this statement follows the responses to the questionnaire given to students regarding the creative thinking instrument in learning economics, which is integrated into the IBT. In detail, students' responses to IBT are shown in Table 6. The data shows that the majority of students agree and strongly agree with the relevance and effectiveness of the creative thinking questions given, reflecting the success of the learning approach applied. This finding also indicates that using creative thinking instruments integrated with IBT is not only relevant and effective but also favoured by students, supporting a more interactive and innovative learning approach. This is in line with research results showing that the use of IBT can indeed support a more interactive and innovative learning approach in higher education, having a positive impact on improving various student skills [104]. In addition, the use of IBT can be well received by students and is considered effective in improving understanding, learning motivation, and creative thinking skills. A total of 98.7% of students felt more motivated to learn with IBT, indicating that this platform is not only an evaluation tool but also a tool that increases students' interest and engagement in learning. This is in line with research results showing that internet-based science learning has been found to positively influence student attitudes and motivation, with appropriate student control and teacher guidance being important to maximize its benefits [105].

Table 6. Student response to the use of IBT.

No.	Statement	Response (%)		
		Strongly agree	Agree	Disagree
1	The instructions given in IBT are simple to understand.	25.3	70.7	4
2	The problems given in IBT are relevant to problems in everyday life.	33.3	66.7	0
3	I feel more motivated to learn through IBT.	22.7	76	1.3
4	IBT's questions explain the economic subject matter very well.	19.4	80.6	0
5	The presentation of reading text, data, pictures, and graphs on IBT is very clear.	0	100	0
6	Questions that require creative thinking are preferable to regular questions.	13.9	86.1	0
7	The time given to complete the test on the IBT is adequate.	75	25	0
8	The feedback provided by IBT after completing the test helped me understand my mistakes.	33.3	60	6.7
9	IBT allows me to measure my creative thinking skills better than traditional tests.	61.3	22.7	16
10	I prefer taking IBT tests over paper and pencil tests.	29.3	60	10.7

5. Conclusions

We examined the effectiveness of using IBT and constructivist learning models in improving students' creative thinking skills in economics education. The development of creative thinking skills is recognized as an essential skill to meet the challenges of the 21st century, yet traditional teaching methods that are still dominant are often unable to facilitate this development. The purpose of this study is to test a problem-solving learning model that can replace conventional teaching methods and improve students' creative thinking skills.

The research used a quasi-experimental approach with the implementation of a constructivism learning model that focuses on problem solving. The creative thinking skills test used was integrated with internet technology, enabling a more efficient and comprehensive assessment of students' creative thinking skills. This method aims to provide an in-depth assessment of students' abilities in creative thinking, facilitating a more interactive and collaborative learning process.

The results showed that the combination of an IBT and a constructivist learning model had a significant positive impact on students' creative thinking abilities. The learning model that relies on problem solving encourages students to actively participate in discussion and collaboration, which in turn develops their critical and creative thinking skills. On the other hand, the use of internet technology in the test allows for a more accurate and targeted assessment of students' creative thinking skills.

This research makes several important contributions to the development of educational science. Firstly, this study developed a problem-solving-based constructivist learning model that proved effective in improving students' creative thinking skills in economic education. Secondly, the integration of internet technology in the assessment process shows its benefits in assessing creative thinking skills more deeply and comprehensively. Thirdly, the findings also emphasize the importance of teacher training in implementing innovative teaching methods to support the development of students' creative thinking skills. However, this study has some limitations. The study was conducted in the context of economics education at one educational institution, so the results may not be generalizable to other educational contexts. Variations in the implementation of the learning model may also occur depending on the ability and experience of the teachers, which suggests the need for consistent training standards. In addition, access to and competence in using internet technology is a barrier for some students and teachers, affecting the study's results based on their technical capabilities.

For future research, several recommendations are made. Firstly, additional research should be conducted to test the effectiveness of this learning model in other educational contexts, such as the natural sciences or humanities, to ensure that similar results can be achieved. Second, the development of a more comprehensive training program for teachers is needed to improve their competence in implementing technology-based and constructivist learning methods. Thirdly, in addition to creative thinking ability, future research could explore the impact of these methods on other skills such as collaboration, communication, and problem-solving abilities. Finally, the development of more holistic assessment tools that can assess different aspects of creative thinking skills as well as academic outcomes simultaneously needs to be considered to provide a more complete picture of students' abilities.

References

1. Medani, D.I.; and Sakti, A.W. (2022). Introduction of Indonesian poem (pantun) as a creative effort of elementary school students in improving language skills in the Covid-19 pandemic era. *Indonesian Journal of Multidiciplinary Research*, 2(1), 229-236.
2. Hafina, A.; and Fitri, Q. (2022). Analysis of adolescent creative thinking skills scale based on creative personality perspective. *Indonesian Journal of Multidiciplinary Research*, 2(2), 477-486.
3. Khusaini, M.; Finuliyah, F.; and Lestari, A.M. (2023). Eco-creative hub model as the key to integrating creativity and sustainability. *Indonesian Journal of Multidiciplinary Research*, 3(2), 435-444.

4. Ayasrah, S.; Obeidat, M.; Katatbeh, Q.; Aljarrah, A.; and Al-Akhras, M.A. (2023). Practicing creative thinking and its relation to academic achievement. *Creativity Studies*, 16(1), 178-192.
5. Tiong, G.H.; and Bakar, A.Y.A. (2022). The engagement of critical and creative thinking activities in the teaching and learning process. *ASEAN Journal of Educational Research and Technology*, 1(2), 139-146.
6. Cao, Y.; Tran, A.; Kim, H.; Robertson, N.; Lin, Y.; Torkel, M.; Yang, P.; Patrick, E.; Ghazanfar, S.; and Yang, J. (2023). Thinking process templates for constructing data stories with SCDNEY. *F1000Research*, 12.
7. Parker, R.M.N. (2022). Planning library instruction research: building conceptual models with theoretical frameworks. *Medical Reference Services Quarterly*, 41(4), 408-423.
8. Horiguchi, T.; Tomoto, T.; and Hirashima, T. (2015). A framework of generating explanation for conceptual understanding based on "Semantics of constraints." *Research and Practice in Technology Enhanced Learning*, 10(1), 2.
9. Serrano-Cámara, L.M.; Paredes-Velasco, M.; Velázquez-Iturbide, J.Á.; Alcover, C.M.; and Castellanos, M.E. (2016). MoCAS: A mobile collaborative tool for learning scope of identifiers in programming courses. *International Journal of Engineering Education*, 32(2), 969-981.
10. Grünkorn, J.; zu Belzen, A.U.; and Krüger, D. (2014). Assessing students' understandings of biological models and their use in science to evaluate a theoretical framework. *International Journal of Science Education*, 36(10), 1651-1684.
11. Tigelaar, D.E.H.; Dolmans, D.H.J.M.; Wolfhagen, I.H.A.P.; and Van Der Vleuten, C.P.M. (2004). The development and validation of a framework for teaching competencies in higher education. *Higher Education*, 48(2), 253-268.
12. Botma, Y.; Van Rensburg, G.H.; Coetzee, I.M.; and Heyns, T. (2015). A conceptual framework for educational design at modular level to promote transfer of learning. *Innovations in Education and Teaching International*, 52(5), 499-509.
13. Wang, B.; and Li, P.-P. (2022). Digital creativity in STEM education: The impact of digital tools and pedagogical learning models on the students' creative thinking skills development. *Interactive Learning Environments*, 1-14.
14. Gu, X.; Ritter, S.M.; Delfmann, L.R.; and Dijksterhuis, A. (2022). Stimulating Creativity: Examining the Effectiveness of Four Cognitive-based Creativity Training Techniques. *Journal of Creative Behavior*, 56(3), 312-327.
15. Sawyer, R.K. (2022). Teaching creative thinking: how design professors externalize their creative thinking in studio classroom talk. *Mind, Culture, and Activity*, 29(1), 21-42.
16. Ritter, S.M.; and Mostert, N. (2017). Enhancement of creative thinking skills using a cognitive-based creativity training. *Journal of Cognitive enhancement*, 1, 243-253.
17. Solihah, P.A.; Kaniawati, I.; Samsudin, A.; and Riandi, R. (2024). Prototype of greenhouse effect for improving problem-solving skills in science, technology, engineering, and mathematics (STEM)-education for sustainable development (ESD): Literature review, bibliometric, and experiment. *Indonesian Journal of Science and Technology*, 9(1), 163-190.

18. Fitrianti, A.; Suwarma, I.R.; and Kaniawati, I. (2024). Improvement of students' literacies skills in the knowledge aspect through science, technology, engineering, and mathematics (STEM)-integrated module. *Indonesian Journal of Teaching in Science*, 4(1), 41-46.
19. Rosen, Y.; Stoeffler, K.; and Simmering, V. (2020). Imagine: Design for creative thinking, learning, and assessment in schools. *Journal of Intelligence*, 8(2).
20. Lestari, D.A.; Suwarma, I.R.; and Suhendi, E. (2024). Feasibility analysis of the development of STEM-based physics e-book with self-regulated learning on global warming topics. *Indonesian Journal of Teaching in Science*, 4(1), 1-10.
21. Fajarwati, A.; Winarno, N.; and Prima, E.C. (2024). Investigating students' creativity through STEM-engineering design process in element, compound, and mixture topic. *Indonesian Journal of Teaching in Science*, 4(1), 69-84.
22. Tipmontiane, K.; and Williams, P.J. (2022). The integration of the engineering design process in biology-related STEM activity: A review of Thai secondary education. *ASEAN Journal of Science and Engineering Education*, 2(1), 1-10.
23. Samala, A.D.; and Amanda, M. (2023). Immersive Learning Experience Design (ILXD): Augmented reality mobile application for placing and interacting with 3D learning objects in engineering education. *International Journal of Interactive Mobile Technologies*, 17(5).
24. Goldie, J. (2016). The implications of brain lateralisation for modern general practice. *British Journal of General Practice*, 66(642), 44-45.
25. Juhanaini, J.; Bela, M.R.W.A.T.; and Rizqita, A.J. (2023). How eyes and brain see color: Definition of color, literature review with bibliometric analysis, and inquiry learning strategy for teaching color changes to student with mild intelligence barriers. *Indonesian Journal of Science and Technology*, 8(3), 561-580.
26. Hugdahl, K. (2000). Lateralization of cognitive processes in the brain. *Acta Psychologica*, 105(2-3), 211-235.
27. Aberg, K.C.; Doell, K.C.; and Schwartz, S. (2017). The "Creative right brain" revisited: Individual creativity and associative priming in the right hemisphere relate to hemispheric asymmetries in reward brain function. *Cerebral Cortex*, 27(10), 4946-4959.
28. Corballis, M.C. (2021). Humanity and the left hemisphere: The story of half a brain. *Laterality*, 26(1-2), 19-33.
29. Gold, R.; Faust, M.; and Ben-Artzi, E. (2012). Metaphors and verbal creativity: The role of the right hemisphere. *Laterality*, 17(5), 602-614.
30. Zhu, W.; Shang, S.; Jiang, W.; Pei, M.; and Su, Y. (2019). Convergent thinking moderates the relationship between divergent thinking and scientific creativity. *Creativity Research Journal*, 31(3), 320-328.
31. Fink, A.; Grabner, R.H.; Benedek, M.; Reishofer, G.; Hauswirth, V.; Fally, M.; Neuper, C.; Ebner, F.; and Neubauer, A.C. (2009). The creative brain: Investigation of brain activity during creative problem solving by means of EEG and fMRI. *Human Brain Mapping*, 30(3), 734-748.
32. Yan, T.; Zhuang, K.; He, L.; Liu, C.; Zeng, R.; and Qiu, J. (2021). Left temporal pole contributes to creative thinking via an individual semantic network. *Psychophysiology*, 58(8).

33. Green, A.E.; Cohen, M.S.; Raab, H.A.; Yedibalian, C.G.; and Gray, J.R. (2015). Frontopolar activity and connectivity support dynamic conscious augmentation of creative state. *Human Brain Mapping*, 36(3), 923-934.
34. Khalil, R.; Karim, A.A.; Kondinska, A., and Godde, B. (2020). Effects of transcranial direct current stimulation of left and right inferior frontal gyrus on creative divergent thinking are moderated by changes in inhibition control. *Brain Structure and Function*, 225(6), 1691-1704.
35. Kim, B. (2001). Social constructivism. *Emerging Perspectives on Learning, Teaching, and Technology*, 1(1), 16.
36. Nugroho, H. (2022). Constructive alignment approach for capstone project with industry involvement: Case study in Malaysia University. ASEAN *Journal of Science and Engineering Education*, 2(1), 37-50.
37. Ojugo, A.A.; and Yoro, R.E. (2021). Extending the three-tier constructivist learning model for alternative delivery: Ahead the COVID-19 pandemic in Nigeria. *Indonesian Journal of Electrical Engineering and Computer Science*, 21(3), 1673-1682.
38. Abrahamson, D.; and Kapur, M. (2018). Reinventing discovery learning: A field-wide research program. *Instructional Science*, 46(1), 1-10.
39. Csizmadia, A.; Standl, B.; and Waite, J. (2019). Integrating the constructionist learning theory with computational thinking classroom activities. *Informatics in Education*, 18(1), 41-67.
40. Bächtold, M. (2013). What do students “Construct” according to constructivism in science education? *Research in Science Education*, 43(6), 2477-2496.
41. Alismaiel, O.A.; Cifuentes-Faura, J.; and Al-Rahmi, W.M. (2022). Online learning, mobile learning, and social media technologies: An empirical study on constructivism theory during the COVID-19 pandemic. *Sustainability* (*Switzerland*), 14(18), 11134.
42. Behrens, H. (2021). Constructivist approaches to first language acquisition. *Journal of Child Language*, 48(5), 959-983.
43. Baerveldt, C. (2013). Constructivism contested: Implications of a genetic perspective in psychology. *Integrative Psychological and Behavioral Science*, 47(1), 156-166.
44. Xie, Z.; Ren, L.; Zhan, Q.; and Liu, Y. (2022). A constructivist ontology relation learning method. *IEEE Transactions on Cybernetics*, 52(7), 6434-6441.
45. Sood, A. (2014). Constructivism in teaching of science (Story-telling approach). *International Journal of Research in Economics and Social Sciences*, 4(9), 55-62.
46. Harjali, H. (2019). Building constructivist learning environment at senior high school in Indonesia. *Qualitative Report*, 24(9), 2197-2214.
47. Mishra, N.R. (2023). Constructivist approach to learning: An analysis of pedagogical models of social constructivist learning theory. *Journal of Research and Development*, 6(01), 22-29.
48. Chapman, J.D.; and Aspin, D.N. (2013). A problem-solving approach to addressing current global challenges in education. *British Journal of Educational Studies*, 61(1), 49-62.

49. McAlpine, C.A.; Seabrook, L.M.; Rhodes, J.R.; Maron, M.; Smith, C.; Bowen, M.E.; Butler, S.A.; Powell, O.; Ryan, J.G.; Fyfe, C.T.; Adams-Hosking, C.; Smith, A.; Robertson, O.; Howes, A.; and Cattarino, L. (2010). Can a problem-solving approach strengthen landscape ecology's contribution to sustainable landscape planning? *Landscape Ecology*, 25(8), 1155-1168.
50. Said-Metwaly, S.; Van den Noortgate, W.; and Barbot, B. (2021). Torrance test of creative thinking-verbal, Arabic version: Measurement invariance and latent mean differences across gender, year of study, and academic major. *Thinking Skills and Creativity*, 39, 100768.
51. O'Shea, J.; and Leavy, A.M. (2013). Teaching mathematical problem-solving from an emergent constructivist perspective: The experiences of Irish primary teachers. *Journal of Mathematics Teacher Education*, 16(4), 293-318.
52. Redecker, C.; and Johannessen, Ø. (2013). Changing assessment-Towards a new assessment paradigm using ICT. *European Journal of Education*, 48(1), 79-96.
53. Deeley, S.J. (2018). Using technology to facilitate effective assessment for learning and feedback in higher education. *Assessment and Evaluation in Higher Education*, 43(3), 439-448.
54. Laborda, J.G.; Sampson, D.G.; Hambleton, R.K.; and Guzman, E. (2015). Guest editorial: Technology supported assessment in formal and informal learning. *Educational Technology and Society*, 18(2), 1-2.
55. Keane, T.; Keane, W.F., and Blicblau, A.S. (2016). Beyond traditional literacy: Learning and transformative practices using ICT. *Education and Information Technologies*, 21, 769-781.
56. Webb, M.; and Gibson, D. (2015). Technology enhanced assessment in complex collaborative settings. *Education and Information Technologies*, 20(4), 675-695.
57. Guerrero-Roldán, A.E.; and Noguera, I. (2018). A model for aligning assessment with competences and learning activities in online courses. *Internet and Higher Education*, 38, 36-46.
58. Dillon, M. (2001). Assessing Information on the Internet: Toward providing library services for computer-mediated communication. *Journal of Library Administration*, 34(1-2), 21-28.
59. Clarke-Midura, J.; and Dede, C. (2010). Assessment, technology, and change. *Journal of Research on Technology in Education*, 42(3), 309-328.
60. Fiandini, M.; and Nandiyanto, A.B.D. (2024). How to calculate economic evaluation in industrial chemical plant design: A case study of gold mining using amalgamation method. *ASEAN Journal for Science and Engineering in Materials*, 3(2), 75-104.
61. Glushchenko, V.V. (2024). Theoretical foundations of the restaurant business. *ASEAN Journal of Economic and Economic Education*, 3(1), 1-16.
62. Mohammed, M.T. (2024). Activity-based management: Article review. *ASEAN Journal of Economic and Economic Education*, 3(1), 17-22.
63. Ali, M.A.; Kamraju, M.; and Sonaji, D.B. (2024). Economic policies for sustainable development: Balancing growth, social equity, and environmental protection. *ASEAN Journal of Economic and Economic Education*, 3(1), 23-28.

64. Abubakar, M.; and Shahzad, A. (2024). Aspect-based sentiment analysis on product reviews. *ASEAN Journal of Economic and Economic Education*, 3(1), 29-34.
65. Ogunjinmi, O.O.; Oyedare, O.O.; and Atanda, A.O. (2024). Economic analysis of yam production under the taungya agroforestry system with cost analysis. *ASEAN Journal of Economic and Economic Education*, 3(1), 35-44.
66. Afolashade, I.S.; Jimoh,A.M.; Raji, N.A.; Fowowe-Ogunmilugba, B.J.; Oduola, O.Z.; and Adewuyi, H.O. (2024). Emotional intelligence, job satisfaction, reward system and organizational commitment among workers. *ASEAN Journal of Economic and Economic Education*, 3(1), 45-60.
67. Meidiansyah, H.; Hurriyati, R.; and Dirgantari, P.D. (2024). The influence of social media endorsement credibility on customers-based brand equity. *ASEAN Journal of Economic and Economic Education*, 3(1), 61-70.
68. Ugli, K.S.U.; and Jasurovna, E.S. (2024). Improving the use of marketing strategies in the modern logistics system. *ASEAN Journal of Economic and Economic Education*, 3(2), 71-78.
69. Norboyev, O.; and Abdurakhmanova, G. (2024). Methods of assessing the efficiency of economic implementation of the level of property capitalization. *ASEAN Journal of Economic and Economic Education*, 3(2), 79-96.
70. Glushchenko, V.V.; and Inei, Y.H.A. (2024). A conceptual approach to the synthesis of the architecture of information and trading systems. *ASEAN Journal of Economic and Economic Education*, 3(2), 97-110.
71. Haq, M.R.I.; Nurhaliza, D.V.; Rahmat, L.N.; and Ruchiat, R.N.A. (2024). The influence of environmentally friendly packaging on consumer interest in implementing zero waste in the food industry to meet sustainable development goals (SDGs) needs. *ASEAN Journal of Economic and Economic Education*, 3(2), 111-116.
72. Ali, M.A.; and Kamraju, M. (2024). Money talks, but what about freebies? Understanding the influence of material benefits in politics. *ASEAN Journal of Economic and Economic Education*, 3(2), 117-142.
73. Muhabbat, H.; and Jakhongir, S. (2024). Harmonization of international valuation standards and international financial reporting standards. *ASEAN Journal of Economic and Economic Education*, 3(2), 143-164.
74. Lawal, S.O. (2024). The economics of recycling: A review compiled with tax and subsidiary, implication for government, decision-makers, enterprises, community, and analysis cost/benefit and market. *ASEAN Journal of Economic and Economic Education*, 3(2), 165-188.
75. Okebiorun, J.O.; and Ige, L.O. (2024). Social entrepreneurship as catalyst for solving socioeconomic problems created by covid-19 pandemic lockdown. *ASEAN Journal of Economic and Economic Education*, 3(2), 189-200.
76. Liu, J.; Chen, J.; He, C.; and Zhou, H. (2023). Leveraging Load-Aware Dynamic Pricing for Cell-Level Demand-Supply Equilibrium. *IEEE Transactions on Vehicular Technology*, 72(5), 6902-6906.
77. Li, Y.C.; and Yang, H. (2017). A mathematical model of demand-supply dynamics with collectability and saturation factors. *International Journal of Bifurcation and Chaos*, 27(1), 1750016.

78. Bárcena-Martín, E.; Rodríguez-Fernández, M.; and Borrego-Domínguez, S. (2017). Golf, supply and demand: The influence of economic factors. *Tourism Economics*, 23(6), 1220-1234.
79. Czyżewski, A.; Bieniek-Majka, M.; and Czakowski, D. (2018). Factors shaping supplydemand relations on the fruit and vegetable market in the light of the behavior of groups and producer organizations. *Management Science*, 22(1), 265-277.
80. Lusk, J.L.; and Tonsor, G.T. (2016). How Meat Demand Elasticities Vary with Price, Income, and Product Category. *Applied Economic Perspectives and Policy*, 38(4), 673-711.
81. Addessi, W.; Pulina, M.; and Sallusti, F. (2017). Impact of changes in consumer preferences on sectoral labour reallocation: evidence from the italian economy. *Oxford Bulletin of Economics and Statistics*, 79(3), 348-365.
82. Vichiengior, T.; Ackermann, C.L., and Palmer, A. (2023). Consumer anticipation as a performative experience. *European Journal of Marketing*, 57(11), 3005-3039.
83. Mohammadi, M.; Mohamadi, D.; and Nikzad, A. (2023). Equilibrium pricing in supply chains with discrete stochastic demands: A case study in coffee supply and distribution industry. *Journal of Industrial and Production Engineering*, 40(5), 360-374.
84. Zhao, W.; Wang, L.; and Zhang, Z. (2019). Supply-Demand-Based Optimization: A Novel Economics-Inspired Algorithm for Global Optimization. *IEEE Access*, 7, 73182-73206.
85. Gravelle, H.; Sutton, M.; Morris, S.; Windmeijer, F.; Leyland, A.H.; Dibben, C.; and Muirhead, M. (2003). Modelling supply and demand influences on the use of health care: implications for deriving a needs-based capitation formula. *Health Economics*, 12(12), 985-1004.
86. Waterman, D. (2007). The effects of technological change on the quality and variety of information products. *Economics of Innovation and New Technology*, 16(8), 587-594.
87. Maccini, L.J. (2016). The impact of demand and price expectations on the behavior of prices. *The American Economic Review*, 68(1), 134-145.
88. Zhang, X.; and Wang, X. (2021). Measures of human capital and the mechanics of economic growth. *China Economic Review*, 68, 101641.
89. Yildirim, S.; Khalafi, M.A.; and Güzel, T. (2023). Supply curves in electricity markets: A framework for dynamic modeling and monte carlo forecasting. *IEEE Transactions on Power Systems*, 38, 3056-3069.
90. Mitridati, L.; and Pinson, P. (2018). A bayesian inference approach to unveil supply curves in electricity markets. *IEEE Transactions on Power Systems*, 33(3), 2610-2620.
91. Wheeler, D.S. (2015). Do you know how much it costs. *Intensive Care Medicine*, 41(8), 1454-1456.
92. Pearson, M. (2003). An equilibrium solution to supply chain synchronization. *IMA Journal of Management Mathematics*, 14(3), 165-185.

93. Nelson, R.R. (2013). Demand, supply, and their interaction on markets, as seen from the perspective of evolutionary economic theory. *Journal of Evolutionary Economics*, 23(1), 17-38.
94. Auld, D.A.L. (2015). Imperfect knowledge and the new theory of demand. *Journal of Political Economy*, 80(6), 1287-1294.
95. Vogel, D.; and Cyrus, N. (2017). Demand reduction in anti-trafficking debates. *ERA Forum*, 18(3), 381-396.
96. Correa, J.R.; Figueroa, N.; Lederman, R.D.; and Stier-Moses, N.E. (2014). Pricing with markups in industries with increasing marginal costs. *Mathematical Programming*, 146(1), 143-184.
97. Cheridito, P.; Horst, U.; Kupper, M.; and Pirvu, T.A. (2016). Equilibrium pricing in incomplete markets under translation invariant preferences. *Mathematics of Operations Research*, 41(1), 174-195.
98. Flåm, S.D. (2016). Monotonicity and market equilibrium. *Set-Valued and* Variational *Analysis*, 24(3), 403-421.
99. Afifah, S.; Mudzakir, A.; and Nandiyanto, A.B.D. (2022). How to calculate paired sample t-test using SPSS software: From step-by-step processing for users to the practical examples in the analysis of the effect of application anti-fire bamboo teaching materials on student learning outcomes. *Indonesian Journal of Teaching in Science*, 2(1), 81-92.
100. Al Husaeni, D.F.; Al Husaeni, D.N.; Fiandini, M.; and Nandiyanto, A.B.D. (2024). The research trend of statistical significance test: Bibliometric analysis. *ASEAN Journal of Educational Research and Technology*, 3(1), 71-80.
101. Gallagher, S.A. (2015). The role of problem-based learning in developing creative expertise. *In Asia Pacific Education Review*, 16(2), 225-235.
102. Chen, P.; and Chan, Y.C. (2021). Enhancing creative problem solving in postgraduate courses of education management using project-based learning. *In International Journal of Higher Education*, 10 (6), 11-21.
103. Boud, D.; and Feletti, G. (2013). *Changing problem-based learning. Introduction to the second edition*. In Boud, D.; and Feletti, G. (Eds.), *The Challenge of Problem-based Learning*, Routledge.
104. Sjoer, E.; Herder, P.; Bogman, F.; Daalen, E.V.; Danes, W.; Dopper, S.; Kruit, M.; Van Peppen, A.; Van De Venn, P.-J.; and Verkroost, M.-J. (2003). Developing and implementing innovative ICT-supported engineering education and educational services: results of a faculty-wide research and implementation programme. *European Journal of Engineering Education*, 28(3), 403-420.
105. Raes, A.; and Schellens, T. (2015). Unraveling the motivational effects and challenges of web-based collaborative inquiry learning across different groups of learners. *Educational Technology Research and Development*, 63(3), 405-430.