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Evaluating pedagogical approaches in business education: a comparative analysis

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ABSTRACT

The emergence of entrepreneurial groups from university students and alumni can trigger the nation's economic advancement. This study investigated the impact of project-based learning (PJBL) models in enhancing students' business management abilities, integrating components such as resource management, financial-administrative structuring, production, marketing, and business development planning. The research aimed to analyze the most effective teaching methods for business education students to improve learning outcomes in business management skills. The research design adopted a pre-post test format with three phases: treatment phase, test phase, and data analysis phase. The data analysis techniques used included Spearman and Kendall's correlation, Friedman, Kendall's W, Kruskal-Wallis, U test, and Wilcoxon test. The results indicated a significant difference, $p<0.05$, between treatments. Based on the mean rank, the PJBL treatment had the highest mean rank value (3.77; 3.77; 110.40), followed by the problem-based learning (PBL) treatment (2.94; 2.94; 87.14), problem-solving (PS) treatment (1.83; 1.83; 50.67), and finally the traditional learning (TL) treatment (1.46; 1.46; 33.79). This research serves as a recommendation policymaker, educators, students, and any individual aiming to enhance business management skills consider PJBL as a primary treatment or PBL and PS as alternative options.

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1. INTRODUCTION

Amidst rapid global industrial transformation, undergraduate business education faces crucial challenges in preparing graduates who can adapt to the changing job market. Various studies have been conducted, covering aspects ranging from gender and study areas to self-perception, which influence the job readiness of business education students [1]. This urgency is supported by research from Tam *et al.* [2], which indicates that appropriate business and entrepreneurship learning processes can enhance job readiness and psychological perceptions. This context demands a thorough evaluation of existing business teaching methods to determine the most effective approach to improving students' business management capabilities as a desired learning outcome. Various studies have attempted to compare two or more learning models to determine which is more effective in specific classroom settings [3], [4]. Approaches like traditional learning (TL), problem-based learning (PBL), problem-solving learning (PS), and project-based learning (PJBL) have been explored and elaborated on in terms of their significant correlations. Several studies have innovated by

combining these methods. However, these studies have only compared two approaches and have not considered the carryover effect and fatigue effect [5]–[7]. These effects are significant as they provide students with meaningful learning experiences. Although previous research can form an initial hypothesis [6], there is a possibility of significant differences in the effectiveness of various teaching methods in business management outcomes, considering the carryover and fatigue effects [8].

This hypothesis needs to be substantiated with comprehensive research, as there is still a gap in the literature regarding their comparative effectiveness in the ever-changing context of business education. This study aims to fill this gap with a comparative analysis of these four methods, which are uniquely contributing to the existing literature review. This matter is of high urgency in business education, where research to bridge this gap can have significant implications and potential for future teaching practices in business education. By considering the carryover and fatigue effects and understanding comparatively which teaching methods are more effective [9], [10], educational institutions can tailor their curriculum and teaching methods [11], [12], in line with the evolving needs of the industry [13]–[15]. The goal is to produce graduates who are knowledgeable and prepared to face the dynamic challenges of the job market. Considering the research gap and this urgency, this study aims to analyze the most effective teaching methods for enhancing business management skills among business education students. The research design employs a pre-post test, considering repetition effects and fatigue. The Friedman test is the primary analysis method for its superior capability in handling data and comparing related samples. This study will also use the Spearman-Kendall correlation test and Cronbach's Alpha test to assess correlation and internal consistency, and the U test and Wilcoxon Signed-Rank test as part of strength of results examination. The selection of these techniques ensures that analysis is robust and reliable in handling data of various formats and distributions. Through this research and analysis, the findings are expected to provide insights and considerations for policymakers, educators, students, and individuals aiming to enhance business skills relevant to current and future industry needs. TL is often categorized by differences in time, tracing back to educational models implemented in the past. Its characteristics focus on educator-centered instruction, with learners seated facing the instructor. The process emphasizes knowledge transfer [16]. This model is frequently compared with newer educational models to assess the advantages of recent developments [17], [18]. The rationale for these comparisons is grounded in factors like the evolution of time, technological advancements, characteristics of learners and educators, the educational environment, and demands from the workforce [19]–[21]. However, this does not imply that TL is now irrelevant. Some studies indicate that conventional learning is as effective as modern models in achieving targeted learning outcomes [17], [22]. This effectiveness can be attributed to external factors beyond the learning material, such as the learners' conditions, readiness to learn, and self-regulation skills in developing personal competencies [23]. Nevertheless, findings suggest doubts about the efficacy of TL in enhancing competencies like creativity and innovation [24], [25]. PBL offers an alternative methodology. It aims not just to meet university grading standards but to lean more towards and promote experiential learning linked with real-world scenarios. This approach effectively prepares learners to understand and implement solutions to actual problems in their knowledge [26]. Unlike TL, PBL centers on the learners' active participation [27], [28]. It enhances 21st-century skills like critical thinking [29], [30]. Furthermore, it has improved professional competencies, particularly in entrepreneurship and business [26], [31]. The outcomes of this learning approach are pivotal in entrepreneurial education, enhancing business management skills.

PS learning is focused on one primary objective: PS through various learning activities. Any approach can be utilized for PS [32]. This specificity distinguishes it from PBL, which is problem-focused but has broader educational objectives. PS learning is highly detailed and focused. Decision-making is a crucial activity in PS, serving as an operational indicator to measure the success of the PS learning model [33]. Hence, these detailed objectives can be categorized as high-level thinking skills in a cognitive context or decision-making and strategy development in a practical context [34]–[36]. PJBL is centered around project creation and is used to measure educational success [3], [37]. It represents an advancement from other problem-based models. Learners systematically engage in pre-planned activities to address identified issues using real-world observation techniques [38]. This model has gained popularity in higher education, especially in Indonesia, because it allows students to demonstrate their thoughts and work through tangible products [39], [40]. These products can have practical applications in broader societal contexts, which is a significant advantage of this model. Based on the literature reviewed, the various educational models mentioned are interconnected through activities, learning objectives, and materials. When compared within each model, none is inherently better or worse; comparisons are context-dependent within specific learning environments.

Business education has undergone significant developments recently. Studies on these developments have been initiated recently, with numerous findings disseminated. The evolution of business education encompasses various aspects, including the political and economic educational environment, learner experiences, relationships with ecosystems, and business school curriculums and internationalization [41]. The integration and utilization of technology, information, and artificial intelligence (AI) have catalytic factors in business education's success [42]. Business education is a field that has evolved through various

criteria, including student development and learning materials. This includes practical business participation by students [43], the use of technology in learning [44]–[46] and the application of various models to support the effectiveness and success of business education [47], [48]. Furthermore, business education can accommodate the enhancement of various student abilities, from theoretical skills like 21st-century capabilities to practical skills [49]–[51]. Based on these observations, it is evident that business education students can develop diverse business skills upon graduation. i) H1: there is a significant difference in the effectiveness of different teaching methods in business student learning outcomes as measured by pre-post tests and ii) H2: different teaching methods in business education have varying levels of effectiveness on learning outcomes as measured by pre-post tests.

2. METHOD

This research employs a pre-post test design, considering factors such as repetition and fatigue effects, as noted in the research phases (refer to Figure 1). The primary analysis technique is the Friedman test with Spearman and Kendall's tests to determine the correlation of treatments with the results of each treatment's pre and post-tests. Additional tests include the Kruskal-Wallis test, U test, and Wilcoxon test for robust difference testing from the primary analysis technique. Normality tests are conducted before difference testing with a standard of $p<0.05$, which is the benchmark for non-parametric testing compared to parametric testing [52], [53]. As previously recommended by experts, if data are found to be non-normally distributed ($p<0.05$), more sensitive analyses such as Spearman correlation and Kendall's correlation, Friedman test, U test, Wilcoxon Signed-Rank test [54], Kruskal-Wallis test. Kendall's W test can be used. The study recruited 140 volunteer business students who agreed to participate in the research without coercion or conflict of interest with all parties. After participants consented, the research was conducted in three main phases (refer to Figure 1): treatment phase, test phase, and data analysis phase. In the treatment phase, participants were randomly divided into four balanced groups. Instructors were given the authority to administer PJBL, PBL, PS, and TL treatments randomly but consistently, with only one treatment per group. The researcher was unaware of the treatments used in each group. Treatments were administered thrice in one week, and participants did not communicate with other treatment groups during this phase to maintain the carryover and fatigue effects. After the treatment phase, instructors were informed about the treatments administered.

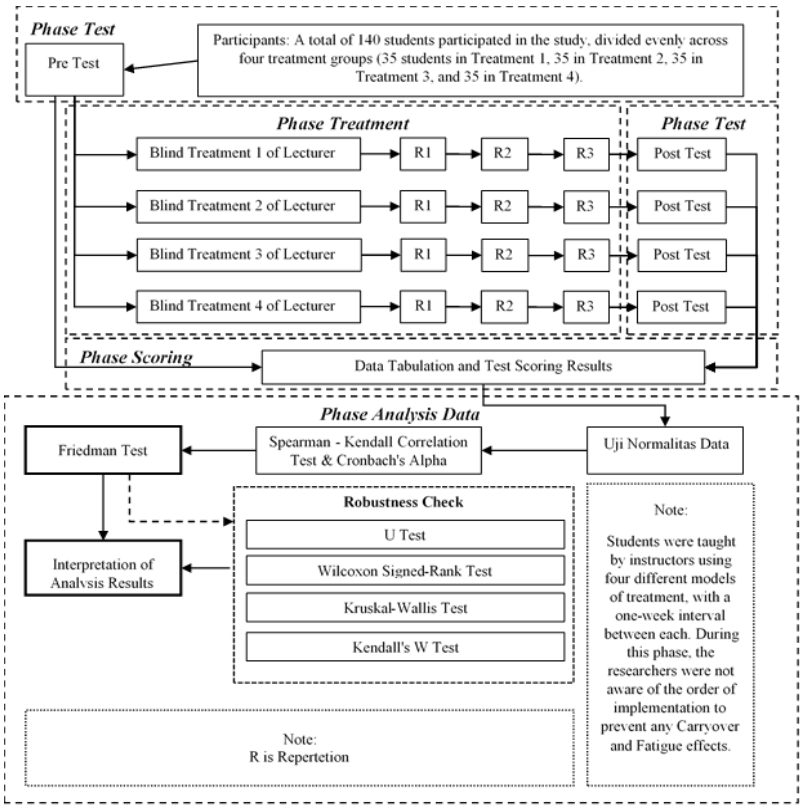

Figure 1. Research phase

Two test instruments assessed learning success through business management skills in the test phase. One set was used for the pre-test and another for the post-test, each consisting of 5 questions with a maximum score of 100 points using a scoring matrix. The pre-test was conducted under strict supervision before the treatment phase, and the post-test was conducted after the treatment series. Pre and post-test assessments were not performed by the instructors to ensure the naturalness of the test results. Evaluators were recruited from business field instructors who were uninvolved in the research and unaware of the treatments used and the students' identities. Rubrics based on indicators were provided as a guide for these evaluators. After completing the treatment and test phases according to the predetermined procedure, data tabulation was conducted, followed by data analysis using techniques such as Spearman correlation and Kendall's correlation, Friedman test, Kendall's W test, Kruskal-Wallis test, U test, and Wilcoxon signed-rank test. Justification of difference testing was done with a significance standard of $p<0.05$ in every analysis technique used [52], [53], and analyzing the mean rank produced.

3. RESULTS

The treatment phase was conducted at one of the major universities in Indonesia and executed according to the predefined procedures (refer to Figure 1). The first treatment session occurred in September 2023, and the repetition was conducted in October 2023. All participants actively attended the treatments, and there were no significant challenges during this phase. After the treatment phase concluded, the teaching professors informed about the groups that had received each treatment. The first test phase, consisting of the pre-test, was conducted in September 2023 with a set of test instruments designed for the pre-test. The post-test was then carried out in December 2023 with a different set of test instruments for the post-test. Each set of pre and post-test instruments had different cases or questions but maintained the same indicators. The assessments were simultaneously conducted by evaluators in December, resulting in a collection of 140 pairs of pre-test and post-test data sets. In this phase, data analysis began with a normality test using the Kolmogorov-Smirnov and Shapiro-Wilk techniques. The data were not normally distributed (see Table 1). Therefore, this study employed Spearman correlation and Kendall's correlation, Friedman test, U test, Wilcoxon Signed-rank test [54], Kruskal-Wallis test and Kendall's W test. This approach is supported by previous research, which suggests that non-parametric tests are necessary when data do not follow a normal distribution or when normality assumptions are not verified [52], [53].

Table 1. Data normality test

Treatment	Kolmogorov-Smirnova		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
PJBL	0.184	0.004	0.865	0.001
PS	0.241	0.000	0.873	0.001
PBL	0.200	0.001	0.923	0.018
TL	0.201	0.001	0.910	0.007
Pre_PJBL	0.219	0.000	0.867	0.001
Pre_PS	0.204	0.001	0.875	0.001
Pre_PBL	0.220	0.000	0.885	0.002
Pre_TL	0.211	0.000	0.864	0.000

The Spearman and Kendall correlation analysis (refer to Table 2) indicated a high consistency in the measurement instruments, with a Cronbach's Alpha value of 0.849, exceeding the threshold of 0.700. This suggests that the instruments used were reliable. Furthermore, there was a significant correlation between the treatments and the post-test scores, with Kendall's correlation value being -0.455 ($p<0.05$, 0.000) and Spearman's correlation value being -0.544 ($p<0.05$, 0.000). These values indicate significant differences among the various treatments provided, suggesting the need for further differential tests to identify these differences more clearly. However, no significant correlation was found between the treatments and the pre-test scores. This implies that the participants' initial knowledge or skill level before receiving the treatments did not significantly vary across different groups.

Table 2. Spearman-Kendall correlation test and Cronbach's Alpha

Variable	N	Kendall's tau_b		Spearman's Rho		Cronbach's
		Value	Sig.	Value	Sig.	Alpha
Post test score	140	-0.445**	0.000	-0.544**	0.000	0.849
Pre test score	140	-0.003	0.968	-0.003	0.968	

Note: category of treatment using code 1, 2, 3, 4; 1 is PJBL treatment; 2 is PS treatment; 3 is PBL treatment; 4 is TL treatment

The analysis results from the different tests using the Friedman test, Kendall W test, and Kruskal-Wallis test techniques (see Table 3) revealed no significant differences ($p>0.05$; values: 0.677; 0.677; 0.472) among the treatments given, as observed from the pre-test scores. However, essential differences ($p<0.05$; values: 0.000; 0.000; 0.000) were found among the treatments based on the post-test scores. According to the mean rank, the PJBL treatment had the highest mean rank values (3.77; 3.77; 110.40), followed by the PBL treatment (2.94; 2.94; 87.14), the PS treatment (1.83; 1.83; 50.67), and lastly, the TL treatment (1.46; 1.46; 33.79).

Table 3. Differential test techniques: Friedman test, Kendall W test and Kruskal-Wallis test

Test	Treatment	SD	Friedman test			Kendall W test				Kruskal-Wallis test		
			Mean rank	Chi-Square	Sig.	Mean rank	Chi-Square	Sig.	Kendall's W[a]	Mean rank	Sig.	Kruskal-Wallis H
Pre test	PJBL	5.229	2.47	1.523	0.677	2.47	1.523	0.677	0.015	69.30	0.925	0.472
	PS	5.396	2.59			2.59				70.86		
	PBL	5.115	2.51			2.51				73.99		
	TL	5.493	2.43			2.43				67.86		
Post test	PJBL	3.802	3.77	80.228	0.000	3.77	80.228	0.000	0.764	110.40	0.000	79.508
	PBL	3.680	2.94			2.94				87.14		
	PS	4.741	1.83			1.83				50.67		
	TL	4.834	1.46			1.46				33.79		

More specifically, using the U test analysis technique (see Table 4), no significant differences were found among the groups based on the pre-test scores for models TU1 through TU6, with findings $p>0.05$ (0.870; 0.613; 0.875; 0.742; 0.752; 0.516). Subsequently, significant differences were found among the treatments through the tested models with $p<0.05$. Starting with TU1, which tested the difference between PJBL and PS treatments, a significant value of $0.000<0.05$ was found, with the PJBL treatment having a higher mean rank (50.37) compared to PS (20.63). In TU2 (PJBL and PBL), a significant value of $0.000<0.05$ was found, with PJBL (44.07) having a higher mean rank than PBL (26.93). TU3 (PJBL and TL) revealed a significant value of $0.000<0.05$, with PJBL (51.96) having a higher mean rank than TL (19.04). TU4 (PS and PBL) showed a significant value of $0.000<0.05$, with PBL (46.31) having a higher mean rank than PS (24.69). TU5 (PS and TL) presented a significant value of $0.012<0.05$, with PS (41.36) having a higher mean rank than TL (29.64). Finally, in TU6 (PBL and TL), a significant value of $0.000<0.05$ was found, with PBL (49.90) having a higher mean rank than TL (21.10). These findings indicate that the TL treatment consistently had the lowest mean rank compared to other treatments (PJBL, PBL, and PS), reinforcing the previous finding that TL had the lowest mean rank. Additionally, when comparing the PJBL treatment against the other three treatments, it was consistently found that PJBL had a higher mean rank than PBL, PS, and TS.

Table 4. U-test differential analysis

Test	Model	Treatment	N	Mean (SD)	MR	U-Test Mann-Whitney U	Z	Sig
Pre test	TU1	PJBL	35	60.10 (5.266)	35.11	599.000	-0.164	0.870
		PS	35		35.89			
	TU2	PJBL	35		34.31	571.000	-0.505	0.613
		PBL	35		36.69			
	TU3	PJBL	35		35.87	599.500	-0.158	0.875
		TL	35		35.13			
	TU4	PS	35		34.73	585.500	-0.329	0.742
		PBL	35		36.27			
	TU5	PS	35		36.24	586.500	-0.316	0.752
		TL	35		34.76			
	TU6	PBL	35		37.03	559.000	-0.650	0.516
		TL	35		33.97			
Post test	TU1	PJBL	35	80.04 (6.364)	50.37	92.000	-6.216	0.000
		PS	35		20.63			
	TU2	PJBL	35		44.07	312.500	-3.604	0.000
		PBL	35		26.93			
	TU3	PJBL	35		51.96	36.500	-6.842	0.000
		TL	35		19.04			
	TU4	PS	35		24.69	234.000	-4.603	0.000
		PBL	35		46.31			
	TU5	PS	35		41.36	407.500	-2.509	0.012
		TL	35		29.64			
	TU6	PBL	35		49.90	108.500	-6.043	0.000
		TL	35		21.10			

Finally, this study analyzed using the Wilcoxon test technique (see Table 5). This technique involved testing data with three models: Wx1 (testing post-test and pre-test data for each treatment), Wx2 (testing pre-test data by comparing among treatments), and Wx3 (testing post-test data by comparing among treatments). The results revealed (model Wx1) significant differences ($p<0.05$) between post-test and pre-test scores for each treatment, with ranks indicating that post-test scores were generally better than pre-test scores in every treatment. It was also found (model Wx3) that there were significant differences ($p<0.05$) among treatments based on post-test scores, where the ranks indicated PS<PJBL, PBL<PJBL, TL<PJBL, PS<PBL, TL<PS, and TL<PBL. This shows a consistent finding where PJBL had a higher rank than PS, PBL, and TL. No significant differences (model Wx2) were found ($p>0.05$) among treatments based on pre-test scores. This indicates consistent findings where pre-test scores across treatments did not differ significantly.

Table 5. Wilcoxon test differential analysis

Wilcoxon test								
Model Wx1			Model Wx2			Model Wx3		
Rank	Z	Sig.	Rank	Z	Sig.	Rank	Z	Sig.
Post PJBL>Pre_PJBL	-5.181[b]	0.000	Pre_PS<Pre_PJBL	-0.552[b]	.581	Post PS<Post PJBL	-4.962[b]	0.000
Post PS>Pre_PS	-5.184[b]	0.000	Pre_PBL<Pre_PJBL	-1.279[b]	.201	Post PBL<Post PJBL	-4.518[b]	0.000
Post PBL>Pre_PBL	-5.178[b]	0.000	Pre_TL<Pre_PJBL	-1.000[c]	.317	Post TL<Post PBJL	-5.032[b]	0.000
Post TL>Pre_TL	-5.176[b]	0.000	Pre_PS<Pre_PBL	-0.776[b]	.438	Post PS<Post PBL	-4.174[c]	0.000
Post PJBL>Pre_PJBL	-5.181[b]	0.000	Pre_TL<Pre_PS	-0.962[c]	.336	Post TL<Post PS	-2.831[b]	0.005
Post PS>Pre_PS	-5.184[b]	0.000	Pre_TL<Pre_PBL	-1.362[c]	.173	Post TL<Post PBL	-4.867[b]	0.000

Note: b. Based on positive ranks, c. Based on negative ranks.

4. DISCUSSION

This study was conducted strictly according to the procedures outlined (see Figure 1) and explored the effectiveness of various teaching methods in enhancing student learning outcomes. The non-parametric analysis, employed due to the non-normal data distribution, revealed several significant findings. In line with recent literature [52], [53], a non-parametric approach is recommended in cases of non-normal data distribution, and this study adhered to that recommendation. The Spearman and Kendall analyses showed consistency in the measurement instruments, with a high Cronbach's Alpha value (0.849), indicating high reliability. A significant relationship was found between the treatment and post-test scores but not with pre-test scores. This indicates that differences in student performance can be directly attributed to the applied teaching methods. The various models studied showed correlation and effectiveness in learning [17], [22], [37]. In the differential analysis, mainly using the Friedman test, Kendall's W test, Kruskal-Wallis test, U test, and Wilcoxon test, significant differences were found in post-test scores among treatments. This finding indicates that each teaching treatment had a different impact on student learning outcomes regarding business management skills. Precisely and consistently, the PJBL treatment showed the highest mean rank, indicating its most significant effectiveness compared to PBL, PS, and TL. Thus, the PJBL technique may be considered the most effective method among those tested. This finding supports research in education that emphasizes the importance of active learning methods in enhancing business management skills as a representation of student learning success in the subject studied [55]. Consistent with previous researchers' findings and evidence, PJBL is the best learning model to be applied in higher education within the social sciences [56]. As an alternative, PBL and PS are suitable alternatives when students experience fatigue and inability to knowledge transfer as a learning outcome [29], [57]–[61]. Based on these results, there is a significant difference in the effectiveness of different teaching methods in the context of student learning outcomes in business measured with pre-post tests, thus accepting Hypothesis 1. Different teaching methods in business education have varying levels of effectiveness on learning outcomes measured with pre-post tests, thus accepting Hypothesis 2. It is essential to recognize the limitations of this study, particularly that it was conducted with business education students, which may not fully represent the diverse learning conditions of students in other fields. Additionally, further research is needed to understand how other contextual factors, such as the demographic background of students and other learning conditions, may influence the effectiveness of different teaching methods. Therefore, these gaps and limitations will be addressed in future research or studies by other researchers.

5. CONCLUSION

This research has been conducted following the strict procedures outlined and explores the effectiveness of various teaching methods in enhancing students' learning outcomes in the form of entrepreneurial skills. This was done through a series of treatment procedures and analytical techniques. There was no significant difference between the treatments in the pre-test scores, which is understandable as

the treatments had not yet been implemented. However, after the post-test was conducted following the treatments, this study consistently found, through all the analytical techniques employed, that all the treatments used had significant differences in their impact on the learning outcomes of entrepreneurial management. The mean rank indicates that PJBL ranked the highest compared to all the treatments used, followed by PBL, participatory simulation, and TL as the last. This suggests that non-TL methods are superior to TL methods. This study recommend policymakers, educators, students, and anyone aiming to enhance entrepreneurial management skills consider PJBL as the primary method or PBL and PS as alternative options. The study innovates in evaluating pedagogical approaches in business education by employing a comprehensive set of non-parametric statistical techniques to assess the effectiveness of PJBL, PBL, PS, and TL, uniquely considering carryover and fatigue effects. This approach is distinct in directly comparing four teaching methodologies within the same study and demonstrating the reliability of measurement instruments through a Cronbach's Alpha value exceeding 0.700. The findings reveal PJBL as significantly superior in enhancing business management skills, challenging traditional teaching preferences and offering concrete recommendations for educators and policymakers. This methodologically robust, empirically supported analysis provides a detailed guide for improving pedagogical strategies, marking a significant contribution to educational literature by proposing practical, data-backed recommendations for curriculum development in business education.

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