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in AI-integrated education, and comparative studies between formal schooling and tutoring institutions. She employs mixed-method research approaches to explore educational outcomes and contribute to policy and innovation in teaching and learning.

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Expertise: Thai dance and drama, folk and religious performance, cultural preservation, contemporary choreography, and community-based arts.

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Her research contributions span both behavioral studies and applied tourism planning. Key projects include analyzing tourist intentions in faith-based tourism in Maha Sarakham Province, and optimizing family travel routes in Buriram using advanced heuristic models. These works combine social science approaches, such as survey analysis, with technical methods like adaptive algorithms, reflecting her interdisciplinary strength. Her studies not only enhance academic understanding but also provide practical insights for local tourism development, helping communities design sustainable tourism experiences.

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Effect of Project-Based Learning on Collaboration Skills of Business Administration Students

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ABSTRACT

Background and Aims: In the context of globalization and the knowledge-based economy, higher education is increasingly expected to prepare graduates with strong collaboration skills required in modern organizations. However, traditional management education often emphasizes theoretical learning and individual assessment, which limits the development of teamwork competencies. Project-Based Learning (PBL), particularly when implemented in authentic and industry-related contexts, has been recognized as an effective instructional approach to promote collaborative learning. This study aimed to 1) compare the collaboration skills of business administration students before and after learning through Project-Based Learning (PBL); 2) compare the collaboration skills of business administration students after learning through PBL with a criterion set at 70 percent; and 3) assess students' satisfaction with learning through PBL.

Methodology: This study employed a pre-experimental one-group pretest–posttest design. The sample consisted of 30 fourth-year business administration students selected through cluster random sampling. The research instruments included six project-based learning (PBL) lesson plans, a collaboration skills observation form, and

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a student satisfaction questionnaire. The lesson plans were validated by experts and demonstrated a very high level of appropriateness (M = 4.87, SD = 0.39). The collaboration skills observation form showed good content validity (IOC = 1.00) and acceptable inter-rater reliability (coefficient > 0.70), while the student satisfaction questionnaire demonstrated high internal consistency reliability (Cronbach's alpha = 0.95). Data were analyzed using descriptive statistics, dependent-samples t-test, and one-sample t-test.

Results: The research results revealed that 1) the students' collaboration skills after the PBL intervention (M = 96.37, SD = 2.39) were significantly higher than before learning (M = 29.77, SD = 6.62) at a significance level of .01 (t_{29} = 49.97, p < .01); and 2) the mean score of students' collaboration skills was 96.37 and the standard deviation was 2.39. which was statistically higher than the criterion of 70% (Full score is 100, criterion score is 70). 3) The overall mean score of student satisfaction with the PBL teaching method was 4.79 (SD = 0.49) on a 5-point scale, indicating very high satisfaction across all dimensions, including effective communication, interpersonal teamwork, role performance, and group processing.

Conclusion: The knowledge gained from this research is that PBL integrated with industry-education integration can effectively enhance business administration students' collaboration skills, which is a result of authentic project practice, team interaction, and dual-tutor guidance. This learning management not only bridges the gap between traditional management education and industry needs but also meets students' demand for comprehensive development. The PBL-based learning management in this study includes core processes such as project introduction, planning, collaborative practice, and evaluation reflection.

Keywords: Project-Based Learning; Collaboration Skills; Business Administration; Industry-Education Integration; Student Satisfaction

Introduction:

In the era of globalization and the knowledge-based economy, higher education plays a critical role in preparing graduates with the competencies required for the

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modern workforce (Wang & Liu, 2024). However, traditional management education, often characterized by lecture-based instruction and examination-oriented assessment, has been criticized for its limited ability to develop collaboration skills and other essential soft skills required in professional settings (Wang, 2017).

To address this issue, two major educational approaches have gained increasing attention: industry–education integration and project-based learning (PBL). Industry–education integration emphasizes cooperation between universities and enterprises to provide authentic learning contexts (Guan, 2024; Xu, 2025), while PBL engages students in real-world problem solving through collaborative projects (Thomas, 2000; Bell, 2010). Although these approaches offer strong potential, their implementation does not automatically result in effective collaboration. In many cases, student projects are completed through task division rather than genuine teamwork, limiting the development of collaborative competencies (Feng et al., 2025).

Collaboration skills are widely recognized as essential competencies for business administration graduates, as modern organizations increasingly rely on cross-functional teamwork, communication, and shared decision-making (OECD, 2018; P21, 2019). However, classroom observations and previous studies indicate that students often experience difficulties in communication, role coordination, and conflict resolution during collaborative tasks, resulting in fragmented teamwork rather than meaningful collaboration.

Previous research has confirmed the positive effects of PBL on student learning; however, most empirical studies have been conducted in engineering and technical disciplines, where task structures and teamwork characteristics differ from those in business and management education (Wang, 2017). Moreover, many studies rely primarily on outcome-based evaluations and provide limited evidence regarding students' real-time collaborative behaviors and interaction processes. These limitations highlight the need for research that systematically examines how PBL can enhance collaboration skills within authentic management learning environments.

Therefore, this study aims to examine the effectiveness of project-based learning in developing collaboration skills and learning satisfaction among business

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administration students in an industry-integrated learning context. The findings are expected to contribute to instructional improvement and curriculum development in management education.

Objectives:

1. To compare the collaboration skills of business administration students before and after learning through Project-Based Learning.

2. To compare the collaboration skills of business administration students after learning through Project-Based Learning with the criterion set at 70 percent.

3. To assess students' satisfaction after learning through project-based learning.

Literature Review:

Project-Based Learning (PBL)

PBL is an instructional approach that integrates real-world projects into teaching, enabling students to construct knowledge and improve abilities by solving practical problems (Fan et al., 2024). Rooted in Dewey's "learning by doing" philosophy (Dewey, 1938), PBL emphasizes authentic contexts, sustained inquiry, and collaborative problem-solving (Larmer et al., 2015). The core process of PBL includes introducing real projects, project planning, collaborative practice, and evaluation reflection (Kilpatrick, 1918), forming a closed loop of "theory-practice-reflection" that aligns with the characteristics of management education.

In the context of industry-education integration, PBL breaks classroom boundaries by integrating enterprise resources, transforming "simulated tasks" into "real production practice" (Yang, 2021). This not only enhances the practical relevance of teaching but also fosters students' collaboration skills through team-based project execution (Chen, 2018).

Collaboration Skills

Collaboration skills refer to the ability to work effectively with others toward shared goals through communication, coordination, and shared responsibility (Johnson & Johnson, 1994). Key components include effective communication, interpersonal teamwork, role performance, and group processing (Cambridge

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Assessment, 2016). These skills are essential for management students to navigate complex cross-functional environments in future careers (P21, 2009).

Research has shown that PBL creates authentic collaborative scenarios where students clarify roles, resolve conflicts, and share responsibilities, thereby continuously improving their collaboration skills (Zhang et al., 2023). For business administration students, PBL-based collaboration not only enhances interpersonal interaction but also integrates professional knowledge application, achieving the dual goals of academic learning and ability development.

Related Studies

Domestic and international studies have confirmed the positive impact of PBL on collaboration skills. Al Rasyid & Khoirunnisa (2021) found that PBL significantly improved students' collaborative behaviors in chemistry courses. Shi (2025) verified that PBL anchored in enterprise projects enhanced students' teamwork and practical abilities in CNC mechanical courses. However, most existing studies focus on engineering disciplines, with limited attention to management education's unique soft skill requirements (Wang, 2017). This study addresses this gap by exploring PBL's effect on collaboration skills in business administration under industry-education integration.

Overall, previous studies consistently indicate that project-based learning can enhance students' engagement, problem-solving ability, and teamwork skills. However, several limitations remain evident in the literature. First, many studies have been conducted in science and engineering contexts, where collaborative tasks are often structured and technically oriented, which differs from the communication-intensive and decision-making nature of collaboration in business administration. Second, existing studies frequently focus on learning outcomes rather than examining collaborative processes, such as interaction patterns, role negotiation, and shared responsibility. Third, limited research has investigated the role of authentic industry participation in shaping students' collaboration experiences. These gaps suggest the need for empirical research that examines how project-based learning implemented

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within industry-integrated environments can effectively develop collaboration skills among business administration students.

Conceptual Framework:

This study investigates the effect of project-based learning (PBL) on students' collaboration skills and learning satisfaction. Project-based learning serves as the independent variable, while collaboration skills and learning satisfaction are treated as dependent variables. Collaboration skills in this study are conceptualized as a multidimensional construct consisting of effective communication, interpersonal teamwork, role performance, and group processing (Johnson & Johnson, 1994; Cambridge Assessment, 2016). These components reflect the behavioral and social competencies required for teamwork in professional contexts. The conceptual framework is grounded in constructivist learning theory and cooperative learning theory, which emphasize active participation, shared responsibility, and knowledge construction through social interaction (Vygotsky, 1978; Johnson & Johnson, 1994). Within the PBL process, students engage in authentic tasks, collaborative planning, and reflective evaluation, which are expected to promote the development of collaboration skills and positive learning experiences.

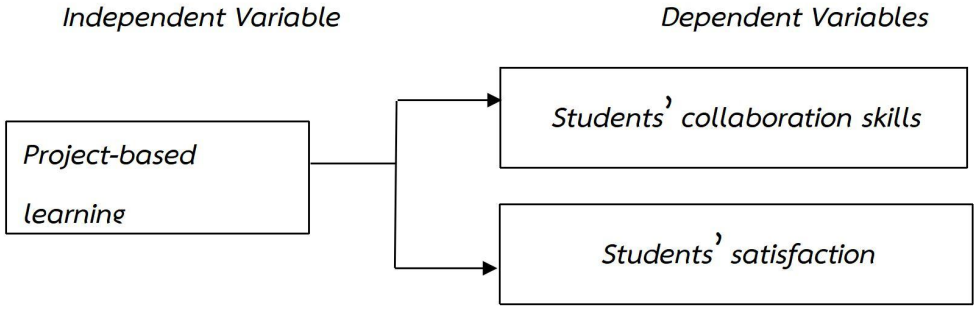


Figure1: Independent variable and dependent variable

Methodology:

1) Population and sample

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1.1) Population: 200 fourth-year students (5 classrooms) majoring in Business Administration at Yunnan University of Business Management, enrolled in the industry-academia collaborative Project Management Course.

1.2) Sample: 30 fourth-year students (1 classroom) majoring in Business Administration at Yunnan University of Business Management, derived by cluster random sampling method, participating in the "Community Cultural Festival Planning Project" commissioned by Yunnan Jiaxin Culture & Media Co., Ltd.

2) Experimental design

This study used one group pretest-posttest design, as shown in the figure. below.

O_1	X	O_2

O_1 was a measurement of the collaboration skills before the experiment

X was the implementation of the project-based learning

O_2 was a measure of the collaboration skills after the experiment

3) Research instruments

3.1) Lesson Plans: Six PBL-based lesson plans (12 total hours) covering topics including project planning theories, SWOT analysis, budget formulation, and community activity execution. Validated by 3 experts (curriculum, teaching, and measurement fields) and demonstrated a very high level of appropriateness, with an overall mean score of 4.87 (SD = 0.39).

3.2) Collaboration Skills Observation Form: A 5-point Likert scale with 20 indicators across 4 dimensions (effective communication, interpersonal teamwork, role performance, group processing). The IOC index with all items having an item–objective congruence (IOC) value of 1.00, and good inter-rater reliability (coefficient=0.795 > 0.70)

3. Student Satisfaction Questionnaire: A 5-point Likert scale with 15 items covering learning effects, teaching strategies, teaching media, and assessment. The instrument demonstrated very high internal consistency reliability, with a Cronbach's alpha of 0.95.

4) Data collection

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The procedures of data collection were as follows:

4.1) The sample was given the pretest by measuring collaboration skills with an observation form.

4.2) The samples were taught using project-based learning.

4.3) After finishing the instruction, the samples received the posttest by using the same instrument that was used in the pretest.

4.4)The sample was given the students' satisfaction questionnaire.

5) Data analysis

5.1) Compare pretest and posttest collaboration skills using a dependent samples t-test.

5.2) Compare collaboration skills after learning through project-based learning using a one-sample t-test.

5.3) Analyze student satisfaction using the arithmetic mean and standard deviation.

The dependent-samples t-test was used to examine changes in students' collaboration skills before and after the intervention, as the same group of participants was measured at two different time points. The one-sample t-test was employed to determine whether students' post-learning scores exceeded the established performance criterion, which represents the expected level of collaboration competency.

It should be noted that this study employed a one-group pretest–posttest design without a control group, which may limit the ability to attribute all observed improvements solely to the intervention. In addition, the sample size was relatively small and drawn from a single institution, which may limit the generalizability of the findings. Therefore, the results should be interpreted as preliminary evidence of effectiveness rather than definitive causal conclusions.

Results:

The findings based on the two research objectives were summarized in this paragraph.

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1) The result of comparing the collaboration skills of business administration students before and after learning through Project-Based Learning

Table 1: Comparison of collaboration skills before and after PBL

Group	Full scores	n	Pretest scores		Post-test scores		t	p
			M	SD	M	SD		
Experimental group	100	30	29.77	6.62	96.37	2.39	49.97**	< .001

***p < .01*

As shown in Table 1, the mean pretest score of students' collaboration skills was 29.77 (SD=6.62), and the posttest mean score was 96.37 (SD=2.39).

Moreover, a dependent samples t-test was conducted to examine whether the improvement in collaborative skills after project-based learning was statistically significant. The results indicated a highly significant difference between the pretest and post-test scores, t_{29} = 49.97, p <.01. This confirms that project-based learning had a strong positive effect on enhancing students' collaborative skills.

2) the results of comparing the collaboration skills of business administration students after learning through Project-Based Learning, with the criterion set at 70 percent

Table 2: The results of the collaboration skills of business administration students after learning through Project-Based Learning, with the criterion set at 70 percent.

Group	n	Full score	criterion score	M	SD	t	p
Experimental group	30	100	70	96.37	2.39	60.55**	< .001

**p < .01*

As shown in Table 2, the mean score of students' collaboration skills was 96.37, and the standard deviation was 2.39. which was statistically higher than the criterion of 70% (Full score is 100.00, criterion score is 70.00). Moreover, this analysis aimed to examine whether students' collaboration skills after learning through Project-Based

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Learning were significantly higher than the criterion score of 70 percent. The results presented in Table 2 indicate that the post- mean score of students' collaboration skills was 96.37 (SD = 2.39), which was significantly higher than the criterion score of 70. The one-sample t-test revealed that the difference was statistically significant at the .01 level, t_{29}= 60.55, p < .01. These findings demonstrate that Project-Based Learning was highly effective in enhancing students' collaboration skills beyond the established criterion.

3) The findings of the satisfaction questionnaire of students after learning through Project-Based Learning

Table 3: Students' satisfaction after learning through Project-Based Learning

Items	*M*	*SD*
1. How satisfied are you with the overall learning effect of this course?	*4.70*	*0.60*
2. How satisfied are you with your mastery of project management-related knowledge through this course?	*4.90*	*0.40*
3. How satisfied are you with the improvement of your relevant skills (such as project planning, teamwork) after completing the course?	*4.77*	*0.57*
4. How satisfied are you with your learning experience during the whole course (such as sense of participation, interestingness)?	*4.80*	*0.48*
5. How satisfied are you with the help of teaching methods adopted by teachers (such as project-based learning) for your study?	*4.83*	*0.38*
6. How satisfied are you with the teaching organization forms of the course (such as group discussion, simulation practice)?	*4.67*	*0.61*
7. How satisfied are you with the interactive design in the course (such as inter-group communication, teacher-student Q&A)?	*4.87*	*0.43*
8. How satisfied are you with the difficulty control and progress arrangement of the course content?	*4.73*	*0.58*
9. How satisfied are you with the applicability of teaching resources used in the course (such as PPT courseware, case materials)?	*4.83*	*0.38*

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Items	*M*	*SD*
10. How satisfied are you with the operational convenience of project management tools and online communication platforms?	*4.63*	*0.72*
11. How satisfied are you with the auxiliary effect of various teaching media (such as tool software, reference materials) on course learning?	*4.83*	*0.53*
12. How satisfied are you with the fairness of the course assessment methods (process evaluation + summative evaluation)?	*4.93*	*0.25*
13. How satisfied are you with the comprehensiveness of the assessment content covering knowledge mastery and skill application?	*4.70*	*0.53*
14. How satisfied are you with the timeliness of teachers' feedback on assessment results?	*4.73*	*0.52*
15. How satisfied are you with the guiding significance of assessment results and teachers' comments for subsequent learning?	*4.90*	*0.31*
Over all	*4.79*	*0.49*

Note. Interpretation of mean scores:

4.50–5.00 = Very high

3.50–4.49 = High

2.50–3.49 = Moderate

1.50–2.49 = Low

1.00–1.49 = Very low

As shown in Table 3, students' satisfaction with learning through Project-Based Learning was at a very high level overall (M = 4.79, SD = 0.49). The mean scores of individual items ranged from 4.63 to 4.93, indicating consistently high levels of satisfaction across all aspects.

The highest mean score was found for satisfaction with the fairness of course assessment methods, including both process and summative evaluation (M = 4.93, SD = 0.25), followed by satisfaction with mastery of project management–related knowledge (M = 4.90, SD = 0.40) and the guiding significance of assessment results and teachers' feedback for subsequent learning (M = 4.90, SD = 0.31).

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Students also reported high satisfaction with interactive course design, teaching methods, learning resources, and skill development. These findings suggest that Project-Based Learning provided a positive learning environment across instructional, organizational, and assessment dimensions.

Discussion:

The findings of this study revealed that students' collaboration skills significantly improved after participating in project-based learning. One possible explanation for this improvement is that the learning activities were based on an authentic enterprise project, the Community Cultural Festival Planning Project, which required students to engage in real-world planning, coordination, and decision-making. Authentic tasks with clear objectives and timelines encouraged students to communicate actively, clarify roles, and take responsibility for shared outcomes.

In addition, the dual-tutor system, consisting of academic instructors and enterprise mentors, played an important role in supporting students' collaborative processes. Enterprise mentors provided guidance based on industry practices, while instructors monitored group dynamics and learning progress. Continuous feedback and process-oriented evaluation helped students improve their teamwork skills throughout the learning process. These findings suggest that authentic projects, structured collaboration, and continuous guidance are key factors contributing to the development of collaboration skills.

The results of this study are consistent with previous research indicating that project-based learning enhances teamwork, communication, and problem-solving skills by engaging learners in meaningful and interdependent tasks (Bell, 2010; Thomas, 2000). A comprehensive review by Kokotsaki, Menzies, and Wiggins (2016) also concluded that project-based learning promotes students' motivation, participation, and collaborative competence across various educational contexts. Furthermore, a systematic review by Guo et al. (2020) reported that project-based learning improves student engagement and interpersonal interaction in higher education.

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Similar findings have also been reported in studies conducted in Chinese higher education. For example, Zhang et al. (2023) found that project-based learning significantly improved students' collaborative behaviors and communication skills in university learning environments, while Wang and Liu (2024) reported that industry–education integration combined with authentic project activities enhanced students' practical abilities and teamwork competence. These studies support the applicability of project-based learning in developing collaboration skills across different educational and cultural contexts.

The high posttest scores observed in this study may be explained by several factors. First, the authentic nature of the project increased students' motivation and sense of responsibility. Second, continuous feedback from both instructors and enterprise mentors supported students' improvement throughout the learning process. Third, the structured project process, including planning, implementation, and reflection, enabled students to progressively develop collaboration skills. However, the findings should be interpreted with caution, as the study employed a one-group pretest–posttest design without a control group, and the sample size was relatively small, which may limit the generalizability of the results.

Regarding students' satisfaction, the results indicated a very high level of satisfaction with project-based learning. This may be attributed to the student-centered nature of PBL, which provides opportunities for active participation, problem-solving, and application of knowledge in real-world contexts. Previous studies have similarly reported that diversified learning activities and timely feedback can enhance students' engagement and learning confidence (Fan et al., 2024).

From a theoretical perspective, the findings of this study support constructivist learning theory and cooperative learning theory, which emphasize active participation, social interaction, and shared responsibility in the learning process. The results suggest that project-based learning can serve as an effective instructional approach for developing collaboration skills and enhancing learning experiences in business administration education.

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Recommendation:

Practical Recommendations

Based on the findings of this study, several practical recommendations can be proposed for instructors and institutions implementing project-based learning in business administration education.

1. Enhancing Project Design: Projects should be designed to reflect authentic industry contexts and require meaningful collaboration. The findings of this study suggest that real-world tasks and clearly structured project processes can effectively promote communication, role negotiation, and shared responsibility among students.

2. Improving Group Formation Strategies: Heterogeneous grouping based on students' abilities, interests, and roles should be considered to support balanced participation. The results indicated that clear role allocation and shared accountability can reduce passive participation and improve teamwork efficiency.

3. Strengthening Instructional Guidance: Instructors should take the role of facilitators by providing continuous guidance during project implementation. Timely feedback, monitoring of group dynamics, and individualized support were found to be important factors contributing to students' collaboration and engagement.

4. Developing Comprehensive Assessment Methods: Assessment of collaboration skills should combine both process and outcome evaluation. Multiple sources of assessment, such as teacher evaluation, peer assessment, and reflective reports, can provide a more comprehensive understanding of students' collaborative performance.

Research Recommendations

Based on the limitations of this study, several directions for future research are suggested.

1. Future studies should include larger sample sizes and participants from multiple institutions or disciplines to improve the generalizability of the findings.

2. Longitudinal studies are recommended to investigate the long-term effects of project-based learning on students' professional competencies and career readiness.

3. Further research may explore the integration of project-based learning with digital technologies, such as online collaborative platforms and virtual simulations, to enhance collaborative learning environments.

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Acceptance Letter for Publication

To **Li Jun, Wassaporn Jirojphan and Kanreutai Klangphahol**

Following the submission of your manuscript entitled **"Effect of Project-Based Learning on Collaboration Skills of Business Administration Students"** to the *Interdisciplinary Academic and Research Journal (Online)*, Old ISSN: 2774-0374 (Online) and New ISSN: 2985-2749 (Online), we are pleased to inform you of the outcome of the editorial and peer-review process.
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The article is scheduled for publication in **Volume 6, Issue 6 (November–December 2026)**. The publication status and progress of the article can be followed online at:
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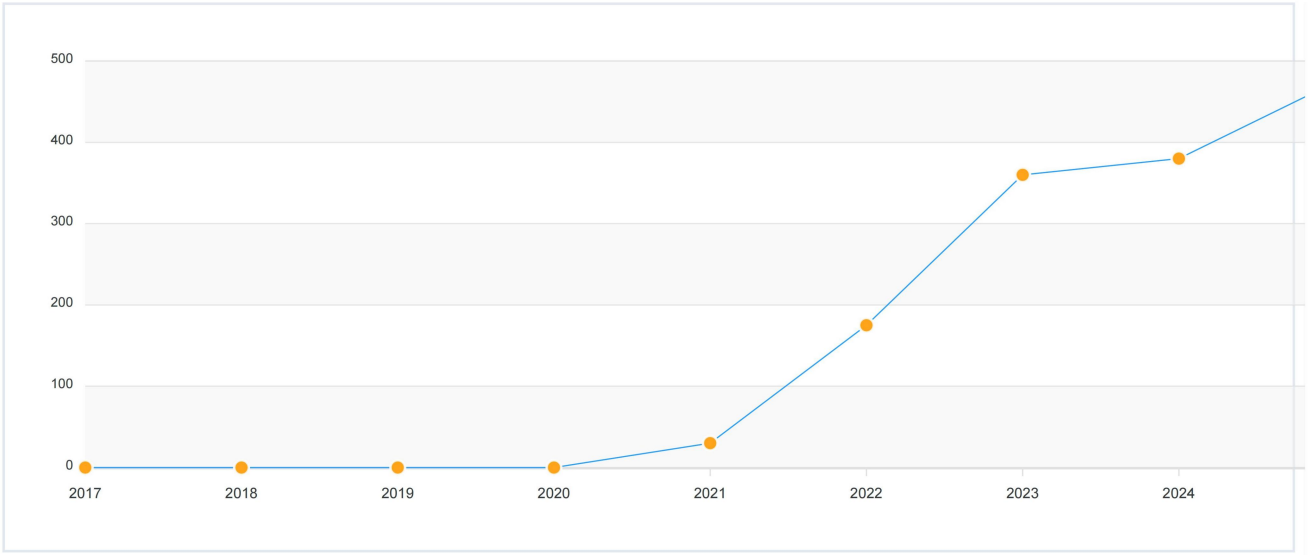


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