

Enhancing Second-Year Vocational Students' Collaborative Skills through Team-Based Learning Combined with Gamification

Xiaodan Tang¹ Rossarin Jermtatsong^{1*} and Pranom Punsawai¹

¹ Faculty of Technical Education, Rajamangala University of Technology Thanyaburi, Thailand

* Corresponding author. E-mail: Rossarin_j@rmutt.ac.th

ABSTRACT

This study aimed to: 1) compare the collaborative skills of second-year vocational students before and after learning management using the traditional teaching method; 2) compare the collaborative skills of second-year vocational students before and after learning management using team-based learning collaboration combined with gamification; and 3) compare the collaborative skills of second-year vocational students between learning management using team-based learning collaboration combined with gamification and the traditional teaching method. The sample consisted of 80 second-year vocational students from 2 classrooms at a college in China, selected through cluster random sampling. The instruments for data collection included lesson plans for the traditional teaching method, lesson plans for team-based learning collaboration combined with gamification, and an assessment of collaborative skills. The data were analyzed using mean, standard deviation, independent-samples t-test, and dependent-samples t-test, along with descriptive statistics and content analysis. The results of the study indicated that: 1) the collaborative skills of second-year vocational students after learning management using the traditional teaching method were significantly higher than those before learning at the statistical significance level of .05; 2) the collaborative skills of second-year vocational students after learning management using team-based learning collaboration combined with gamification were significantly higher than those before learning at the statistical significance level of .05; and 3) the collaborative skills of second-year vocational students after learning management using team-based learning collaboration combined with gamification were significantly higher than those after learning management using the traditional teaching method at the statistical significance level of .05.

Keywords: Team-Based Learning, Gamification, Collaborative Skills

© 2026 JSSP: Journal of Social Science Panyapat

Introduction

Career guidance courses play a critical role in higher education, particularly within China's vocational college system, which is explicitly oriented toward employment outcomes. Vocational colleges in China generally operate under a three-year curriculum, during which students undertake enterprise-based internships in their final year and typically transition directly into employment upon graduation.

Within this educational structure, participation in career guidance courses during the first two academic years is especially significant, as these courses are expected to prepare students for professional practice by fostering essential competencies required in the workplace. Recent research on Chinese higher vocational students highlights that challenges in this formative period can hinder the development of sustainable employability (Huang et al., 2025). Insufficient engagement during this formative period may negatively affect students' internship performance and limit their ability to adapt effectively to real-world work environments.

Among the professional competencies emphasized in vocational education, collaborative skills have attracted increasing scholarly attention. Ellis & Han (2021) define collaborative skills as the capacity to collectively apply procedural knowledge while assuming shared responsibility for group processes in pursuit of common objectives. These skills are closely associated with academic achievement, career development, and employability. In this study, collaborative skills were operationalized into five key dimensions: 1) shared understanding, referring to the ability to develop a common interpretation of tasks and goals; 2) active listening and participation, reflecting students' engagement and responsiveness during group interaction; 3) constructive dialogue, involving the exchange of ideas through reasoned discussion; 4) role negotiation, indicating the ability to coordinate and adjust responsibilities within a team; and 5) accountability, representing shared responsibility for group outcomes. From an industry perspective, employers consistently report that graduates who demonstrate effective communication, cooperative behavior, and constructive teamwork attitudes tend to perform more successfully in professional contexts (Yadav et al., 2024). In career guidance courses, collaboration is essential for activities such as career decision-making and peer interaction, requiring context-specific instructional support.

Collaboration is also widely recognized as a key educational outcome at both national and international levels. The Program for International Student Assessment (PISA), for instance, identifies collaborative competence as a core capability that supports learners' social, emotional, and cognitive development in contemporary societies (Graesser et al., 2018). Complementing this perspective, research on teamwork has consistently demonstrated that effective collaboration enhances group performance and learning outcomes across both academic and occupational settings (Salas et al., 2004; Mathieu et al., 2017).

Despite its acknowledged importance, fostering collaborative skills within educational settings remains challenging. Prior research indicates that although collaboration is frequently emphasized in educational policies and curricula, its practical implementation often lacks clear instructional standards, appropriate assessment instruments, and systematically designed teaching methods (Thornhill-Miller et al., 2023). Ellis & Han (2021) further observe that many students struggle to monitor and reflect on the development of their own collaborative abilities during learning experiences. Common deficiencies include limited listening skills, ineffective articulation of ideas, and weak negotiation abilities within group contexts. Instructors similarly report that students typically enter higher education with little formal preparation in collaboration, which constrains their capacity to engage meaningfully in group-based learning activities (Cherbonnier et al., 2025).

In the vocational college where this study was conducted, traditional teaching methods continued to dominate career guidance courses for second-year Architectural Engineering students. These

approaches emphasized structured content delivery, clear learning objectives, and teacher-centered guidance, contributing to a stable learning environment. However, classroom observations revealed notable collaborative limitations. During group activities, students struggled with shared decision-making and demonstrated limited collective responsibility. Discussions were often dominated by a few individuals, while others remained passively disengaged, indicating limited experience in shared accountability (Gillies, 2016; Loes, 2022). Additionally, students had difficulty sustaining meaningful peer interaction, particularly in career-related tasks requiring negotiation from diverse perspectives. This aligns with Roselli (2016), who argued that traditional instruction provides insufficient opportunities to develop higher-order collaborative skills. Therefore, although these methods supported foundational knowledge acquisition, their effectiveness in fostering collaborative competencies in this context remained limited, highlighting the need for alternative instructional approaches.

These persistent challenges highlight the need for pedagogical strategies that deliberately and systematically promote collaborative skill development, especially among second-year students in vocationally oriented institutions. One instructional approach that has gained increasing attention is team-based learning, which emphasizes active participation, mutual accountability, and structured communication within small groups (Arumugam et al., 2024). Empirical studies indicate that team-based learning can enhance student engagement, learning satisfaction, motivation, and problem-solving abilities through carefully designed collaborative tasks and peer accountability mechanisms (Ngoc et al., 2020; Andrews-Dickert et al., 2024; Burton et al., 2021).

At the same time, gamification has been increasingly adopted as a strategy to enhance student motivation and engagement in learning. When appropriately designed, gamification can encourage active participation and support productive learning behaviors (Triantafyllou et al., 2025). Common elements such as points, badges, and leaderboards have been shown to reinforce intrinsic motivation and self-regulated learning (Brandenburger & Janneck, 2023). Additional research suggests that gamification may also foster learner confidence, appreciation of diverse perspectives, and sustained engagement through feedback mechanisms and role-playing activities (Chen & Liang, 2022).

Although team-based learning and gamification have each been shown to be effective instructional strategies, empirical studies examining their deliberate integration to develop collaborative skills remain scarce. Recent reviews indicate that while gamified elements are increasingly incorporated into collaborative learning contexts, they are often treated as additive motivational tools rather than integral components of collaborative pedagogy (García-Tudela & Marín-Marín, 2025). Similarly, research on team-based learning has primarily focused on conventional classroom implementation, with limited attention to how game-based or technology-enhanced elements may strengthen its collaborative mechanisms (Neo et al., 2023). Furthermore, Zairon et al. (2025) highlighted that adaptive gamification in collaborative environments remains underexplored, particularly in aligning motivational design with structured collaborative learning to foster competencies such as shared accountability and constructive dialogue. This gap underscores the need for a more intentional approach that moves beyond treating gamification and team-based learning as parallel techniques and instead synthesizes their core principles into a unified instructional process. Accordingly, the present study develops a learning management model integrating

team-based learning with gamification and examines its effects, in comparison with the traditional teaching method, on the collaborative skills of second-year undergraduate students in a vocational college context.

This study positions collaborative skills not as a fixed interpersonal trait, but as a learnable process competence shaped through structured interaction, shared accountability, and iterative feedback. By integrating team-based learning and collaboration combined with gamification, this research advances a pedagogical framework that explicates how motivational design and collaborative structure jointly enable the systematic development of collaborative skills in vocational career guidance contexts.

Research Objectives

1. To compare the collaborative skills of second-year vocational students before and after learning management using the traditional teaching method.
2. To compare the collaborative skills of second-year vocational students before and after learning management using team-based learning collaboration combined with gamification.
3. To compare the collaborative skills of second-year vocational students who learned through team-based learning collaboration combined with gamification with those who learned through the traditional teaching method.

Research Methodology

A quasi-experimental design was employed, comprising an experimental group that received team-based learning integrated with gamification and a control group that received a traditional teaching method.

1. Population and Sample.

The population of this study consisted of 200 second-year vocational students enrolled in the Architectural Engineering program across five classrooms at a college in China during the first semester of the 2025 academic year (September–December 2025). The research sample included 80 students selected from two intact classrooms. Cluster random sampling was used to assign one classroom to the experimental group and the other to the control group, thereby ensuring group comparability while preserving the natural classroom structure.

2. Research Instrument.

The research instruments were classified into those used in the experiment and those used for data collection. With details as follows:

2.1 Lesson Plan Using the Traditional Teaching Method. The traditional teaching method lesson plan was developed for second-year vocational students and implemented through three steps: 1) introduction to the topic, 2) lesson delivery, and 3) summary of key points. The learning content focused on Area 2: Employment Preparation and Actions Exploration, and was delivered over eight instructional hours, divided into two tasks: Task 1: How can one find the ideal job? (4 hours). Task 2: How to be a well-presented professional? (4 hours). Content validity was evaluated by a panel of five experts using the Index of Item-Objective Congruence (IOC), which yielded values ranging from 0.8 to 1.00.

2.2 Lesson Plan Using Team-Based Learning Collaboration Combined with Gamification. The experimental lesson plan integrated the structured processes of team-based learning with principles of

gamification. Team-Based Learning comprised four steps: 1) preparation phase, 2) readiness assurance (including individual tests, team tests, and immediate feedback), 3) application exercises (based on the 4S framework), and 4) peer evaluation. Gamification was embedded through a five-step process: 1) preparation phase, 2) clarification of rules and objectives, 3) application of knowledge, 4) immediate feedback, 5) evaluation phase. Team-Based Learning combined with Gamification was conceptualized by aligning the structured collaborative processes of Team-Based Learning with the motivational elements of Gamification to enhance participation, engagement, and collaborative skills. The KGAFE instructional model was developed by mapping key principles of both approaches into a coherent sequence: Knowledge Preparation and Game-oriented Readiness were derived from preparation processes, Interactive Knowledge Application from collaborative task activities, Real-Time Feedback Loop from immediate response mechanisms, and Reflective Evaluation from reflective practices. The model comprises five phases: (1) knowledge preparation, (2) game-oriented readiness, (3) interactive knowledge application, (4) real-time feedback loop, and (5) reflective evaluation

The instructional content mirrored that of the control group, covering Area 2: Employment Preparation and Actions Exploration over 8 hours, divided into the same two tasks. Content validity was confirmed by five experts, with an IOC value of 0.8–1.00. To ensure standardization of the experimental intervention, the researchers followed a detailed lesson plan and maintained reflective journals throughout the teaching period to verify faithful implementation of each stage of the KGAFE model.

2.3 Collaborative Skills Assessment Rubric. A rubric was developed to assess collaborative skills within the college career guidance context. The rubric comprised five dimensions: 1) shared understanding, 2) active listening and participation, 3) constructive dialogue, 4) role negotiation, and 5) accountability. Each dimension included two behavioral indicators, resulting in 10 assessment criteria rated on a five-level performance scale. Content validity was verified by five experts using the IOC technique. The rubric demonstrated content validity, with an Item-Objective Congruence (IOC) index of 1.00 and internal consistency reliability, as indicated by a Cronbach's alpha of 0.89.

3. Research Hypothesis

3.1 The collaborative skills of the second-year vocational students after learning management using the traditional teaching method were higher than those before learning at the statistical significance level of .05.

3.2 The collaborative skills of the second-year vocational students after learning management using team-based learning collaboration combined with gamification were higher than those before learning at the statistical significance level of .05.

3.3 The collaborative skills of the second-year vocational students after learning management using team-based learning collaboration combined with gamification were higher than those after learning management using the traditional teaching method at the statistical significance level of .05.

4. Data Collection

Data collection was conducted between September and December 2025 at Guangxi Modern Polytechnic College after obtaining formal permission from the School of Civil Engineering. The researcher coordinated with the academic administration to explain the research objectives, procedures, and potential impact on regular teaching activities. Institutional approval and support were secured prior to

implementation. The study population consisted of 200 second-year vocational students from five classes. Using cluster random sampling, two comparable classes were selected, with one assigned to the experimental group and the other to the control group. Before the intervention, both groups were informed about the study purpose, procedures, confidentiality, and participant responsibilities to ensure voluntary participation.

A pre-test assessment of collaborative skills was administered to both groups to establish baseline data. The instructional intervention was then implemented during the College Career Guidance course, with the researcher serving as the instructor for both groups to ensure consistency. The control group received traditional instruction, while the experimental group participated in team-based learning combined with gamification. Student participation and group interaction were observed throughout the intervention to support result interpretation. At the end of the course, a post-test assessment of collaborative skills was administered to both groups. The pre- and post-test data were analyzed using appropriate statistical methods, organized in tabular form, and interpreted in relation to the research objectives to evaluate the effectiveness of KGAFE model in enhancing collaborative skills.

5. Data analysis

Statistical analyses were conducted using standard statistical software. Descriptive statistics, including mean and standard deviation, were calculated to summarize students' collaborative skills. A dependent-samples t-test was applied to examine pretest–posttest differences in collaborative skills within each instructional condition. An independent-samples t-test was used to compare posttest collaborative skills between students receiving team-based learning collaboration combined with gamification and those taught using the traditional teaching method. Effect sizes (Cohen's *d*) were calculated using the mean difference divided by the pooled standard deviation, and 95% confidence intervals were reported to estimate precision. The reliability of the collaborative skills instrument was assessed using Cronbach's alpha, with coefficients reported for each dimension. Although the same instructor implemented both conditions to ensure consistency, potential teacher expectancy and implementation bias were considered when interpreting the results.

The Conceptual Framework

The selection of the KGAFE model as the instructional intervention was grounded in prior research demonstrating its effectiveness in developing student competencies. Team-based learning promotes structured collaboration, shared responsibility, and active engagement, contributing to critical thinking, communication, and collaborative problem-solving skills (Arumugam et al., 2024). It has also been shown to enhance student engagement, learning satisfaction, decision-making, and meaningful teacher–student interaction, while supporting the application of knowledge to real-life contexts (Andrews-Dickert et al., 2024; Burton et al., 2021).

Gamification complements this structure by strengthening motivation and engagement through dynamic feedback and goal-oriented challenges. Empirical evidence indicates that gamified environments foster intrinsic motivation, sustained participation, and positive behavioral change (Triantafyllou et al., 2025), while game elements such as points, leaderboards, and interactive platforms increase involvement, enjoyment, and exploratory learning behaviors (García-Iruela & Hijón Neira, 2018; Brandenburger & Janneck,

2023). Within this framework, collaborative skills were defined as the key dependent variable, representing essential competencies for employability and professional readiness. Prior studies have emphasized their importance for workplace performance and adaptability (Okolie et al., 2022; Thianthai & Sutamchai, 2022). Therefore, the integration of these approaches was expected to create a structured and motivating learning environment that supports the development of collaborative skills among second-year vocational students.

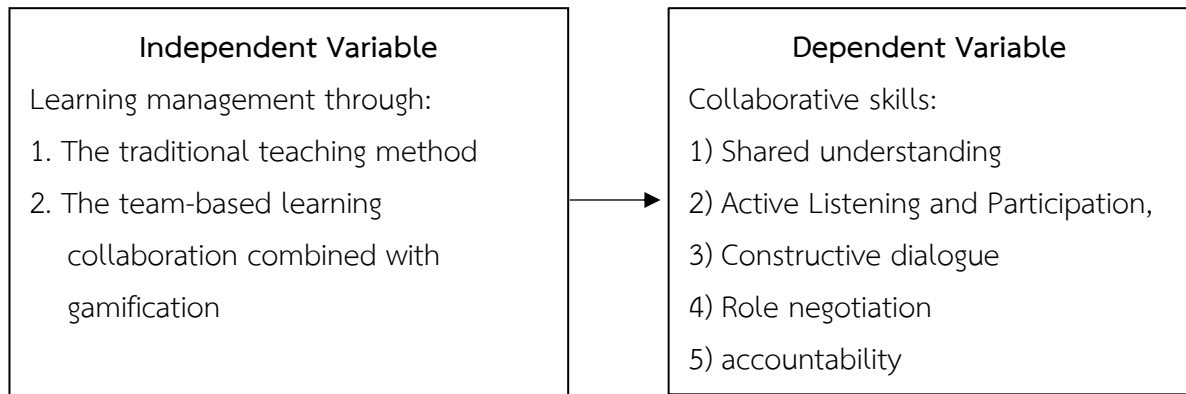


Figure 1 Conceptual Research Framework.

Research Results

1. Comparison analysis of collaborative skills of second-year vocational students before and after learning management using the traditional teaching method.

The post-test mean score (\bar{x} = 27.48, S.D. = 3.04) was higher than the pre-test mean score (\bar{x} = 22.40, S.D.= 2.44). The results of the paired samples t-test indicated that the difference between the two mean scores was statistically significant at .05. This finding indicates that the traditional teaching method improved students’ collaborative skills. The effect size was large (Cohen’s d = 0.84), indicating a substantial increase in students’ collaborative skills following the traditional teaching method, as shown in Table 1.

Table 1 Comparison of Collaborative Skills Before and After Learning Management Using the Traditional Teaching Method (Paired Samples t-test)

Traditional teaching method	Number of Units (n)	Mean (\bar{x})	Standard Deviation (S.D.)	Computed t-value (t)	Degrees of Freedom (df)	Sig. (p-value)	Cohen’s d
Before	40	22.40	2.44	18.239*	39	0.000	0.84
After	40	27.48	3.04				

2. Comparison analysis of collaborative skills of second-year vocational students before and after learning management using team-based learning combined with gamification.

The post-test mean score (\bar{x} = 31.98, S.D. = 1.31) was substantially higher than the pre-test mean score (\bar{x} = 23.00, S.D.= 1.13). The results of the paired samples t-test revealed a statistically significant difference between the pre-test and post-test scores at the .05 level. This result suggests that KGAFE model was highly effective in enhancing second-year vocational students' collaborative skills. The

magnitude of the effect was very large (Cohen's $d = 2.30$), demonstrating that KGAFE model produced a strong practical impact on collaborative skill development, as shown in Table 2.

Table 2 Comparison of Collaborative Skills Before and After Learning Management Using Team-Based Learning Combined with Gamification (Paired Samples t-test).

KGAFE Model	Number of Units (n)	Mean (\bar{x})	Standard Deviation (S.D.)	Computed t-value (t)	Degrees of Freedom (df)	Sig. (p-value)	Cohen's d
Before	40	23.00	1.13	29.85*	39	0.000	2.30
After	40	31.98	1.31				

3. Comparison analysis of collaborative skills of second-year vocational students between learning management using team-based learning combined with gamification and the traditional teaching method.

An independent Welch's t-test was conducted to compare the collaborative skills of students taught using KGAFE model and those taught using the traditional teaching method. Due to unequal variances, Welch's t-test was applied. The results indicated that students who learned through KGAFE model achieved significantly higher collaborative skills ($\bar{x} = 31.98$, S.D. = 1.31) than those who learned through the traditional teaching method ($\bar{x} = 27.48$, S.D. = 3.04). The difference between the two groups was statistically significant at the .05 level. The between-group comparison revealed a large effect size (Cohen's $d = 1.48$), indicating a substantial difference in collaborative skills between the groups, as shown in Tables 3 and 4.

Table 3 Levene's Test for Equality of Variances

F	Df1	Df2	Sig.
22.25	1	75	0.001

Since the significance value of Levene's test was less than .05, the assumption of equal variances was violated. Therefore, Welch's t-test was applied.

Table 4 Comparison of Collaborative Skills of Second-Year Vocational Students between Team-Based Learning with Gamification and Traditional Teaching Methods. (Equal variances not assumed)

Learning Management	Number of Units (n)	Mean (\bar{x})	Standard Deviation (S.D.)	Computed t-value (t)	Degrees of Freedom (df)	Sig. (p-value)	Cohen's d
KGAFE model	40	31.98	1.31	8.602*	53	0.000	1.48
Traditional	40	27.48	3.04				

Note: Cohen's d was used to estimate the effect size. According to Cohen (1988), $d = 0.20$ indicates a small effect, $d = 0.50$ a medium effect, and $d = 0.80$ a large effect.

Discussions

1. Effects of Traditional Teaching Method on Collaborative Skills

Although traditional teaching is commonly characterized as teacher-centered, the findings indicate that it can still foster collaborative skills when implemented with a clear structure and instructional purpose. Well-sequenced instruction, explicit task guidance, and predictable routines appear to support foundational collaboration processes, including role clarity, task coordination, and procedural compliance. This aligns with cognitive structuring theory, which suggests that organized instruction reduces extraneous cognitive load and enables learners to focus on coordinated group performance (Klein et al., 2023). However, collaboration developed through traditional instruction remains largely operational. Rather than fostering deep interdependence or co-construction of meaning, it primarily facilitates cooperation through shared expectations and instructional clarity. Consistent with Dietrich & Evans (2022) and Pen & Singh (2025), traditional teaching thus functions best as a baseline scaffold, supporting limited but measurable collaborative skills without fully enabling higher-order collaborative competence.

2. Effects of Team-Based Learning Combined with Gamification on Collaborative Skills

The substantial improvement in collaborative skills following team-based learning combined with gamification indicates that this instructional integration operates at a qualitatively different level of learning engagement. Unlike traditional instruction, the KGAFE model actively structures positive interdependence, individual accountability, and iterative interaction, which are core mechanisms in social constructivist and collaborative learning theories. Team-based learning compels learners to negotiate meaning, justify decisions, and coordinate roles under conditions of shared responsibility, closely mirroring professional collaborative environments (Andrews-Dickert et al., 2024; Burton et al., 2021). Gamification further amplifies these processes by introducing motivational affordances such as immediate feedback, challenge progression, and visible performance indicators, which sustain engagement and regulate group dynamics (Dichev & Dicheva, 2017; Triantafyllou et al., 2025).

Theoretically, the observed gains suggest a synergistic interaction between cognitive structuring (via TBL) and motivational regulation (via gamification). While team-based learning establishes the cognitive and social architecture for collaboration, gamification energises and stabilises participation, reducing social loafing and enhancing accountability. This finding extends prior research by demonstrating that collaborative skill development is maximised not through isolated instructional strategies, but through intentional orchestration of cognitive, social, and motivational design elements.

3. Comparative Effects of the Two Instructional Approaches

The significantly superior collaborative skill outcomes associated with the KGAFE model underscore the limitations of traditional teaching methods in cultivating higher-order collaboration competencies. While traditional teaching methods support cooperation through task alignment and procedural compliance, they lack design mechanisms that promote negotiation, shared ownership, and adaptive teamwork. In line with Chen and Liang (2022) and Matyakhan et al. (2024), gamified team-based environments enhance self-efficacy, sustained participation, and emotional investment, thereby deepening collaborative engagement.

Crucially, this study extends collaborative learning theory by demonstrating that collaborative skills are not merely behavioural by-products of group activity, but emergent competencies shaped by

instructional system design. From a design-based perspective, collaboration should be conceptualised as a dynamic learning outcome arising from the alignment of instructional structure, learner agency, and motivational feedback. The KGAFE model exemplifies how such alignment transforms surface-level collaboration into an integrated cognitive and social competence.

Taken together, these findings suggest a theoretical shift from viewing collaboration as an inherent consequence of group work to understanding it as a design-dependent outcome of pedagogical and technological orchestration. This perspective provides a critical bridge from discussion to conclusion by foregrounding the role of intentional instructional design in shaping collaborative capacity within technology-enhanced higher education contexts.

This study had several limitations that should be considered when interpreting the findings. First, to ensure instructional consistency, the same instructor taught both the experimental and control groups; however, this may have introduced experimenter expectancy effects, as the instructor's expectations or enthusiasm could have unintentionally influenced student performance (Bell et al., 2022). In addition, as intact classrooms were used, potential selection bias may have affected group equivalence. Second, the sample was limited to students from a single major (Architectural Engineering) at a vocational college in Guangxi, which restricts the generalizability of the findings. Third, the intervention duration was relatively short (eight hours). As noted by Gillies (2016), collaborative skills such as shared accountability and constructive dialogue require time to develop; therefore, short-term interventions may not fully capture this process. Furthermore, students' awareness of participating in an intervention may have introduced a Hawthorne effect. Accordingly, caution is warranted when applying these findings to other disciplines or extended time frames without further research.

Originality and Body of Knowledge

The instructional model developed in this study is grounded in two well-established pedagogical theories: Team-Based Learning and gamification. Team-Based Learning emphasizes structured collaborative learning through systematic phases, including preparation, readiness assurance, application exercises, and peer evaluation, which collectively support knowledge construction, accountability, and teamwork. Gamification, on the other hand, focuses on enhancing learner engagement and motivation by incorporating game-oriented rules, feedback mechanisms, and evaluative elements into non-game learning contexts. Together, these theories provide a complementary foundation for understanding the cognitive and motivational dimensions of learning in vocational and career-oriented education.

Building on these theoretical foundations, this study does not merely apply Team-Based Learning and gamification as parallel instructional techniques. Instead, it synthesizes their core principles into a unified and structured instructional process that responds to the practical demands of career guidance and professional skill development. This synthesis yields a new instructional framework, the KGAFE instructional model, that integrates collaborative learning and motivational design in a process-oriented manner.

The KGAFE instructional model consists of five sequential phases: (1) Knowledge Preparation, (2) Game-Oriented Readiness, (3) Interactive Knowledge Application, (4) Real-Time Feedback Loop, and (5) Reflective Evaluation. These phases reflect a deliberate alignment of the procedural logic of Team-Based

Learning with the motivational dynamics of gamification, forming a coherent learning sequence that supports both active participation and reflective learning.

By articulating the instructional process into clearly defined phases, the KGAFE model contributes new pedagogical knowledge by shifting the focus from method-based implementation to process-based instructional design. The model provides a transferable framework that can be adapted to similar vocational and higher education contexts where collaborative skills, engagement, and applied learning outcomes are central objectives. KGAFE phases were mapped to collaborative skills with Game-Oriented Readiness addressing active listening and role negotiation, Interactive Knowledge Application promoting constructive dialogue and collaborative problem-solving, Real-Time Feedback Loop fostering accountability, and Reflective Evaluation supporting self-regulation. The overall structure and flow of the proposed instructional process are visually presented in Figure 1, which illustrates the newly developed KGAFE model and highlights its potential for replication and further empirical investigation.



Figure 2 KGAFE model

Conclusion

This study demonstrates that collaborative skills are not incidental by-products of group activity but competencies that can be intentionally cultivated through systematic instructional design. The findings provide robust evidence that team-based learning combined with gamification produces significantly stronger collaborative skills than traditional teaching, underscoring the critical role of aligning cognitive structuring with motivational regulation in higher education pedagogy. From a theoretical perspective, this study extends collaborative learning theory by conceptualizing collaboration as an emergent competence arising from instructional systems design rather than as a function of individual disposition or group configuration alone. This reconceptualization shifts the analytical focus from learner traits to the orchestration of pedagogical, social, and motivational mechanisms within learning environments.

In practice, the results highlight the need for higher education institutions to move beyond unstructured group work and adopt theory-informed, design-based instructional models that explicitly target collaborative skill development. Such approaches are essential for preparing vocationals with transferable collaboration competencies, increasingly demanded in both academic and professional contexts. At the institutional level, these findings suggest that collaborative skill development should be embedded as a core curricular outcome and supported through instructional design frameworks that integrate pedagogical structure.

Recommendations

1. Recommendations for applying the research results.

Higher education institutions should move beyond treating collaboration as an implicit by-product of group work and instead adopt systematically designed instructional models that intentionally integrate cognitive structures with motivational mechanisms. Collaborative skill development should be explicitly positioned as a curricular goal, supported by aligned instructional strategies, learning activities, and assessment rubrics. In this regard, professional development policies need to prioritize instructors' capacity to design and facilitate team-based learning processes and implement gamification elements in ways that meaningfully support learning objectives rather than encourage superficial engagement. Such institutional support is essential for ensuring the effective and sustainable implementation of collaborative learning innovations in vocational and higher education contexts.

2. Recommendations for Future Research

Future research should examine how different configurations and intensities of team-based learning and gamification influence specific dimensions of collaborative skills across diverse disciplines and educational levels. Longitudinal studies are particularly needed to investigate the sustainability, transferability, and real-world applicability of collaborative competencies beyond a single course or instructional period. Additionally, further inquiry into instructional design fidelity and teacher decision-making processes would provide valuable insights into how variations in implementation quality mediate collaborative learning outcomes and contribute to the effectiveness of integrated pedagogical models.

References

- Andrews-Dickert, R., Nagaraj, R., Zhan, L., Knittig, L., & Zhao, Y. (2024). Improving learning experience through implementing standardized team-based learning process in undergraduate medical education. *BMC Medical Education*, 24(1), 1098.
- Arumugam, B., Shoraf, P., Sanjana, L., Mahendran, C., Ramesh, T., & Sakthipriyan, S. (2024). Implementation of team-based learning for MBBS students – An innovative teaching learning method in medical education. *Journal of Education Technology in Health Sciences*, 11(1), 28–33.
- Bell, M. L., Whitehead, A. L., & Julious, S. A. (2022). Guidance for the design and analysis of pilot and feasibility studies. *Journal of Clinical Epidemiology*, 142, 253-263.
- Brandenburger, J., & Janneck, M. (2023). A gamified career guidance platform with the potential to motivate young people intrinsically. In 7th *International GamiFIN Conference 2023* (pp. 25–36). Lapland, Finland: Tampere University
- Burton, R., van de Mortel, T., & Kain, V. (2021). Applying team-based learning in a transnational post-registration bachelor of nursing program in Singapore. *BMC Nursing*, 20(1), Article 82.
- Chen, J., & Liang, M. (2022). Play hard, study hard? The influence of gamification on students' study engagement. *Frontiers in Psychology*, 13, 994700.
- Cherbonnier, A., Hémon, B., Michinov, N., Jamet, E., & Michinov, E. (2025). Collaborative skills training using digital tools: A systematic literature review. *International Journal of Human-Computer Interaction*, 41(7), 4155–4173.

- Dichev, C., & Dicheva, D. (2017). Gamifying education: What is known, what is believed and what remains uncertain: A critical review. *International Journal of Educational Technology in Higher Education*, 14(1), 9.
- Dietrich, H., & Evans, T. (2022). Traditional lectures versus active learning--a false dichotomy?. *STEM Education*, 2(4), 275-292.
- Ellis, R., & Han, F. (2021). Assessing university student collaboration in new ways. *Assessment & Evaluation in Higher Education*, 46(4), 509-524.
- García Iruela, M., & Hijón Neira, R. (2018). How gamification impacts on vocational training students. In *International conference on artificial intelligence in education* (pp. 99-103). Cham: Springer International Publishing.
- García-Tudela, P. A., & Marín-Marín, J. A. (2025). Gamification, collaborative learning and transversal competences: Analysis of academic performance and students' perceptions. *Smart Learning Environments*, 12(1), 2.
- Gillies, R. M. (2016). Cooperative learning: Review of research and practice. *Australian Journal of Teacher Education*, 41(3), 39-54.
- Graesser, A. C., Fiore, S. M., Greiff, S., Andrews-Todd, J., Foltz, P. W., & Hesse, F. W. (2018). Advancing the science of collaborative problem solving. *Psychological Science in the Public Interest*, 19(2), 59-92.
- Huang, Z., Phatchareephorn Bangkheow, Phisanu Bangkheow, & Sarayuth Sethakhajorn. (2025). Strategies for promoting sustainable employability development among students in higher vocational colleges. *Higher Education Studies*, 15(1), 166-180.
- Klein, K., Calabrese, J., Aguiar, A., Mathew, S., Ajani, K., Almajid, R., & Aarons, J. (2023). Evaluating active lecture and traditional lecture in higher education. *Journal on Empowering Teaching Excellence*, 7(2), 6.
- Loes, C. N. (2022). The effect of collaborative learning on academic motivation. *Teaching & Learning Inquiry*, 10(4), 1-17.
- Mathieu, J. E., Hollenbeck, J. R., van Knippenberg, D., & Ilgen, D. R. (2017). A century of work teams in the Journal of Applied Psychology. *Journal of Applied Psychology*, 102(3), 452-467.
- Matyakhan, T., Chaowanakritsanakul, T., & Santos, J. A. L. (2024). Implementing gamification to enhance reading engagement and reading comprehension of Thai EFL university students. *LEARN Journal*, 17(1), 212-239.
- Neo, M., Ismat, Z., & Mahendru, N. (2023). A game-based augmented reality experience for team-based learning in a Malaysian classroom: Its impact on student learning. In *ICERI2023 Proceedings* (pp. 4857-4862). Valencia, Spain: IATED.
- Ngoc, P. N., Cheng, C. L., Lin, Y. K., Wu, M. S., Chu, J. S., & Tang, K. P. (2020). A meta-analysis of students' readiness assurance test performance with team-based learning. *BMC Medical Education*, 20(1), 223.
- Okolie, U. C., Oluka, B. N., Oluwayemisi, F. B., Achilike, B. A., & Marcel Ezemoyih, C. (2022). Overcoming obstacles to collaborative learning practices: A study of student learning in higher education-based vocational education and training. *International Journal of Training Research*, 20(1), 73-91.

- Pen, S., & Singh, P. (2025). A comparative analysis of traditional and interactive teaching methods in English. *International Journal of Research in English*, 7(1), 625-629.
- Roselli, N. D. (2016). Collaborative Learning: Theoretical Foundations and Applicable Strategies to University. *Journal of Educational Psychology-Propositos y Representaciones*, 4(1), 251-280.
- Salas, E. E., & Fiore, S. M. (2004). *Team cognition: Understanding the factors that drive process and performance*. Washington, DC: American Psychological Association.
- Thianthai, C., & Sutamchai, K. (2022, May). Skills that matter: Qualitative study focusing on the transfer of training through the experience of Thai vocational students. *Frontiers in Education*, 7, 897808.
- Thornhill-Miller, B., Camarda, A., Mercier, M., Burkhardt, J.-M., Morisseau, T., Bourgeois-Bougrine, S., Vinchon, F., El Hayek, S., Augereau-Landais, M., Mourey, F., Feybesse, C., Sundquist, D., & Lubart, T. (2023). Creativity, critical thinking, communication, and collaboration: Assessment, certification, and promotion of 21st century skills for the future of work and education. *Journal of Intelligence*, 11(3), 54.
- Triantafyllou, S. A., Georgiadis, C., & Sapounidis, T. (2025). Gamification in education and training: A literature review: SA Triantafyllou et al. *International Review of Education*, 71(3), 483-517.
- Yadav, M., Mittal, S., Kumar, M., Sahoo, A., & Jayarathne, P. A. (2025). From textbooks to teamwork: The importance of collaboration skills in workforce preparation. In *Revitalizing student skills for workforce preparation* (pp. 333-352). New York: IGI Global Scientific Publishing.
- Zairon, I. Y., Wook, T. S. M. T., Salleh, S. M., & Dahlan, H. A. (2025). Adaptive gamification in collaborative virtual classroom: a systematic review. *PeerJ Computer Science*, 11, e3146.