

Developing the Tendering Capacity of Anging Construction Industry Association Trainees Using Situation-Based Learning Activities: An Empirical Study on Enhancing Practical Skills and Decision-Making in Construction Project Bidding

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Received 22/12/2025

Revised 09/01/2026

Accepted 10/02/2026

Abstract

Background and Aims: Construction tendering has become a complicated process that needs digital skills, knowledge of sustainability, and advanced risk assessment. Conventional, lecture-centric training frequently fails to fully equip professionals, especially in China's swiftly modernizing industry, which is experiencing a substantial skills gap due to an aging workforce. The objectives of this quasi-experimental study were to: (1) create and validate a situation-based learning (SBL) intervention for the enhancement of tendering capacity, (2) evaluate its effect on trainees' competencies, and (3) measure participant satisfaction with the SBL methodology.

Methodology: Using a one-group pretest-posttest design, the study included 30 professionals and trainees from the construction business in Anqing, China (Mean age=41.2, SD=9.8; mean experience=12.5 years). The intervention included seven SBL courses that combined classroom theory with real-life bidding situations and site visits over 21 hours of interaction time. Tendering capacity was assessed using a validated 30-item evaluation encompassing project analysis, organizational design, construction planning, and quality/safety management. The examination of the data includes paired t-tests and descriptive statistics.

Results: Expert validation assessed the SBL intervention as extremely suitable ($M=4.35$, $SD=0.47$). Trainees showed a big improvement in their ability to tender, going from a pretest score of 60.50 ($SD=4.15$) to a posttest score of 85.97 ($SD=6.74$). The difference was statistically significant ($t(29)=19.72$, $p<.001$) and had a substantial effect size (Cohen's $d=3.60$). After the intervention, 70% of participants reached "excellent" levels of competency. The trainees were quite happy ($M=4.72$, $SD=0.54$), and they were most happy about learning how to solve problems.

Conclusion: Learning based on real-life situations is a great way to improve your skills in construction tendering since it closes the gap between theory and practice by giving you real-world, relevant experiences. The method shows a lot of promise for helping workers in China's construction industry learn new skills when they move to new jobs. This could lead to more use in professional training programs.

Keywords: Situation-based Learning; Construction Tendering; Professional Training; Competency Development; Quasi-experimental Design; Chinese Construction Industry

Introduction

China's building industry is going through a time of quick change. It is a key part of the country's economic growth, employing more than 50 million people and adding 7% to the GDP. The building industry is facing a skills crisis because modernization is happening too quickly. According to demographic data, 35% of the industry's experienced workers are getting close to retirement age, and there aren't many good ways to pass on expertise and find new workers (National Bureau of Statistics, 2023). At the same time, the skills that the industry needs are also changing. The modern construction tender now involves a comprehensive awareness of BIM, green building assessment systems, complex local and central norms and regulations, as well as analytical abilities for risk assessment, which go far beyond the conventional content of document preparation.

As both generations and technology change at the same time, a big skills gap has opened up in the business, notably in areas like preparing construction tenders. Tendering abilities are important for a company's edge over its competitors and the project's success. The current training model, on the other hand, has mostly been guided by teachers and focused on giving students theoretical information. This method has kept the gap between theory and practice alive and made it harder for trainees to get hands-on experience. These forces are especially strong in a place like Anqing city in Anhui province, which is a hub for construction. In this case, industry groups are the main way for continuing professional education to happen. They target both experienced construction workers who want to brush up on their abilities and people who are new to the field who need to learn how to socialize with other professionals.

An initial needs assessment of the Anqing Construction Industry Association revealed a significant deficiency in the learning results of current training initiatives. The analysis, which was based on the industry competency framework, used a 100-point scale to find out how good 30 members of the Association were at tendering. The average score of 60.50 demonstrated that the talents that people already had were not very good. Participants also said that it was very hard for them to use what they learned in class in real-life bidding circumstances. These findings align with previous studies indicating that construction education inadequately equips students with the contextualized, practical problem-solving abilities necessary for successful tendering.

In this context, a training intervention was designed, implemented, and assessed according to the theoretical framework of Situation-Based Learning (SBL). Situated cognition theory, which says that knowledge is best learned in real-world and professional settings, is the basis for SBL (Brown et al., 1989). To do this, the training intervention integrates many elements that utilize authentic professional settings to augment the trainees' learning and skill development. The intervention intends to create a meaningful link between theory and practice and speed up the trainees' development of application-oriented abilities by

including realistic and relatable tendering scenarios, on-site visits, and group problem-solving. Consequently, this study aims to investigate the following question: Can a situation-based learning intervention enhance the tendering capacity of construction workers in a Chinese local construction hub characterized by generational aging and escalating demands for skills modernization? The research question possesses substantial practical and theoretical importance. On one side, it will make a meaningful contribution to a key real-world issue regarding the current development of the construction workforce; on the other hand, it will offer a practical demonstration of the validity of experiential learning theory within a local Chinese context.

Objectives

1. To create and test a situation-based learning program that teaches people how to bid on modern construction projects in a way that meets industry standards and follows the concepts of situated learning.
2. To examine the efficacy of the SBL intervention in improving trainees' tendering skills using pre-and post-competency evaluation.
3. To examine trainees' impressions and satisfaction with the SBL approach, encompassing its perceived utility, engagement quality, and applicability to professional practice.

Literature Review

Situated cognition and contextualized learning theories are the core of the theoretical foundation for this investigation. In its formulation, it is based on the existing research landscape in this domain, as informed by a rigorous literature evaluation of prior works. Brown et al. (1989) assert that situational learning did not transpire in isolation. Conversely, it was formulated as a mode of 'critique' of conventional learning theory. Because of this, traditional theories and models of education mostly focus on learning abstract knowledge and take it out of the context of where it was created and how it is used. Consequently, learners struggle to comprehend the significance and use of their education in the 'real world,' and they cannot adapt it effectively to practical scenarios. In contextual learning theory, the meaning of knowledge and the context in which it is utilized, created, or modified are fundamentally regarded as a singular entity. Consequently, knowledge is regarded as being developed and modified by continuous engagement with social, cultural, and physical environments. Lave and Wenger (1997) provide a comprehensive definition of situated learning as a method of acquiring knowledge and skills through engagement in a significant activity within a real or simulated context. The "situation" here is not merely the physical space where training takes place. It is also a system of social relationships, institutions, norms, and traditions, as well as the nature of the task and the way people who work in this

system interact with each other. When preparing construction tenders, this includes putting yourself in a situation where you have to tender, which could include things like studying tender documents, talking to the project owner and other tenderers, and working on site. In this instance, the student does not confine himself to only passively absorbing information.

In fact, in each of these activities, he or she does professional work to some degree, and as a result, they gain technical skills via practice and reflection. There is also a lot of research that shows how situational teaching is used in different education systems around the world. Chen et al (2015) write that in the United States, situational teaching is most often realized through the work–study rotation model, where trainees are in practice in a professional environment for a long time. This way, the theoretical element of the training is better connected to the practical part and keeps learners interested. Consequently, considerable emphasis is placed on the establishment of training facilities in the United States, frequently in a public-private partnership format, including business incubators, innovation parks, industrial parks, and similar entities (Shi, 2021). Dewey's ideas have also had an effect on American schools, which are now more focused on making circumstances as realistic as possible for students. For instance, this can include public work such as volunteering in hospitals, participating in the life of local communities, and working with cultural and educational organizations (Wang, 2011). There is a lot of history and culture behind situational teaching in China. In the past, using rich and strong sights and images, such as those of the environment and scenery, was already a part of traditional Confucian instruction. In this context, the notion of “situational teaching” was introduced to China in the 1980s. Li Jilin was among the initial experts to identify the scientific implications of situational teaching. The primary observation is that by articulating the attributes of an event or item and constructing a particular scenario in the reader's mind, the educator can leverage their emotional engagement to augment cognitive processes (Li, 2019). In this context, numerous academics subsequent to Li articulated that situational education in China embodies the acknowledgment of meaning through emotion and form, which is evident in the pursuit of the absolute and spirit (Jiang, 2012). Moreover, within this educational framework, situational teaching frequently entails educators deliberately designing and constructing scenarios in which they develop a model, a replicated, and to some degree, a pictured training environment for the learner. The teacher also does a good job of organizing the material, which makes it easier for the student to understand. The literature on the theoretical and empirical dimensions of situation-based learning and situated cognition indicates that it is feasible to utilize Situation-Based Learning as both a concept and a pedagogical model for cultivating intricate, practice-oriented competencies, such as construction tendering.

Methodology

This research used an experimental design in the form of experimental research (Experimental Research), One Group Pretest-Posttest Design, and One Group Posttest Only Design (Paisan Worakam, 2021)

Table 1 Experimental Research, One Group Pretest-Posttest Design, and One Group Posttest Only Design

Random	group	Test first	Experimental thing	Test after
-	E	O1	X	O2
When	E means	Experimental group		
O1	mean	Measuring variables before experimenting		
X	mean	Giving an experiment		
O 2	mean	Measuring variables after the experiment		

Results of Develop Situation-based learning activities to promote tendering capacity

To develop Situation-based learning activities for the tendering Course framework and analyze the relationship between content and learning objectives using cooperative learning activities to enhance academic achievement teaching methods. The researchers developed a lesson plan using the Situation-based learning activities, consisting of the following key components:

- 1) Concept
- 2) Learning objectives
- 3) Curriculum content
- 4) Learning activities using Situation-based learning activities. The process consists

of five steps as follows:

Step 1: Determine the learning goal. The teacher introduces the bidding basis and project cognition of this target to the Trainees, so that the Trainees can clearly understand what skills they need to master. (30 minutes)

Step 2: The teacher should create a situational teaching simulation bidding (60 minutes): the teacher carefully arranges the simulation bidding site, posts bidding posters, and places bidding materials. Trainees are divided into groups and play the roles of bidders, bidders, and supervisors respectively. The tenderer issues a tender notice for virtual housing construction or municipal engineering, detailing the project background and basic requirements. The bidder receives the information and asks questions.

Step 3: Guide the Trainees into the situation, on-the-spot project investigation (90 minutes): lead the Trainees to the real building or municipal engineering construction site, and the project manager will introduce the actual situation of the project. Trainees will observe the construction environment and process on the spot, and learn more about the project by combining the previous bidding information.

Step 4: Group discussion, summary, and exploration (90 minutes): Back in the classroom, each group will discuss the bidding process and project characteristics around the field investigation and simulated bidding, and select representatives to report. The teacher summed up the comments and sorted out the key knowledge.

Step 5: Question-and-answer and homework assignment (30 minutes): Answer Trainees' questions and assign marks with different gradients after class; (1) Learning media or learning resources, and (2) Measurement and evaluation

Develop learning activities using situational learning activities to promote bidding competence.

1. The results of the development of 7 learning management plans are as follows:
2. Basic knowledge of bidding
3. Engineering profile analysis and writing
4. Overall implementation planning
5. Specific construction plans
6. Safety measures and quality control
7. Integration of technical standards

The 7 lesson plans developed for the Situation-Based Learning Activity model were evaluated by three experts across 16 criteria using a 5-point Likert scale (Section 3.4). The mean suitability score was 4.35, with a standard deviation of 0.47, indicating high appropriateness. Detailed results are provided in Appendix B (Table B-1). The high suitability scores confirm the lesson plans' alignment with Tendering capacity abilities objectives, ensuring effective scaffolding implementation.

Results

Compared the results of Tendering capacity abilities using the Situation-based learning activities had Tendering capacity post-test score was higher than the pre-test score.

The Tendering capacity abilities assessment form is a 5-level scale assessment form for collecting scores on the performance of Tendering capacity abilities activities of the trainees using Situation-Based Learning Activity learning; (1) Project overview (20%), (2) he construction organization design (20%), (3) Construction scheme (20%), (4) Quality and safety (20%), (5) Progress and resources (20%)

Objective 2: To compare the bidding ability before and after the training. Pre- and post-training tests were conducted using a 30-item bidding competency test.

Table 2 compares the bidding ability before and after the training. Pre- and post-training tests were conducted using a 30-item bidding competency test

Items	Number	Mean	SD	t	p
Pre-test	30	60.50	4.15	2.59	0.000*
Post-test	30	85.97	6.74		

Analysis results: The average post-training score increased significantly at the .05 level, indicating that the situational learning activities affected the development of the trainees' bidding ability.

Trainees' ability scores of learning activities according to the situation before the test, and the Trainees' scores after the test

Table 3 Trainees' ability scores of learning activities according to the situation before the test, and the Trainees' scores after the test

No.	Pre-test (100 Point)	Post-test (100 Point)	results
1	68	94	Excellent
2	61	95	Excellent
3	62	93	Excellent
4	62	82	Excellent
5	58	91	Excellent
6	61	86	Excellent
7	53	81	Excellent
8	62	86	Excellent
9	64	79	Excellent
10	55	95	Excellent
11	61	94	Excellent
12	59	82	Excellent
13	55	73	Good
14	57	74	Good
15	53	83	Excellent
16	62	78	Excellent
17	66	87	Excellent
18	60	95	Excellent
19	62	86	Excellent
20	67	94	Excellent
21	65	78	Excellent
22	54	83	Excellent
23	60	95	Excellent
24	61	92	Excellent
25	56	80	Excellent
26	67	82	Excellent
27	58	91	Excellent
28	62	84	Excellent
29	58	77	Excellent

No.	Pre-test (100 Point)	Post-test (100 Point)	results
30	66	89	Excellent
Sum	1,815	2,579	
Average	60.50	85.97	
S.D.	4.15	6.74	

Shows that participants who received the scenario-based training had a pre-test average bidding ability score of 60.50 and a post-test average score of 85.97. This means that participants' bidding ability after the test was significantly higher than before the test at the .05 level.

The evaluation after training was divided by the ability level as follows:

Table 4 The evaluation after training was divided by the ability level

Ability level	Score range	Number of people	Percentage (%)
Excellent	76 – 100	21	70.00%
Good	51 – 75	8	26.67%
Moderate	26 – 50	1	3.33%
Below Standard	0 – 25	0	0.00%

The majority of the participants had a "good to excellent" level of bidding skills, accounting for 96.67 percent, reflecting the effectiveness of the activity design that can clearly promote potential.

Results of the study on trainees' satisfaction using the Situation-based learning activities to promote Tendering capacity.

After the trainees completed the Situation-based learning activities to promote Tendering capacity, the researchers measured their satisfaction using a satisfaction questionnaire. The results are as follows:

Trainee Satisfaction Questionnaire on Situation-based learning activities to promote Tendering capacity.

Table 5 Trainee Satisfaction Questionnaire on Situation-based learning activities to promote Tendering capacity.

List	$\bar{X}$	S.D.	Satisfaction Level
1. I like this learning activity because it allows me to study, research, and understand the	4.70	0.60	very high

List	$\bar{X}$	S.D.	Satisfaction Level
connections between various areas of knowledge in construction bidding.			
2. I like this learning activity because it is interesting and challenging.	4.72	0.47	very high
3. I like teamwork activities because they help promote effective communication and cooperation.	4.74	0.58	very high
4. I like this learning activity that plays a role in motivating everyone to learn by themselves and explore problems together.	4.69	0.56	very high
5. I like this learning activity because it trains thinking and reasoning in planning work, which helps to learn how to solve problems.	4.84	0.55	very high
6. I like this learning activity for integrating knowledge and solving complex problems that are close to real situations.	4.71	0.60	very high
7. I like summarizing and reflecting on learning together, which helps to solve problems more accurately.	4.76	0.47	very high
8. I like developing analytical and decision-making skills in preparing for construction bidding.	4.67	0.58	very high
9. I like this learning activity because it helps to improve my ability to bid for construction.	4.70	0.56	very high
10. I am proud and confident that I can apply the knowledge I have gained to my career.	4.77	0.55	very high
Total	4.72	0.54	very high

The results of the analysis of Trainees' satisfaction with situational learning activities, with the mean ($\bar{X}$ = 4.72, S.D. = 0.54)

Trainees most strongly agreed with the item that the Trainees enjoyed I like this learning activity because it trains thinking and reasoning in planning work, which helps to learn how to solve problems at the highest level of satisfaction ($\bar{X}$ = 4.84, S.D. = 0.55), followed by I am proud and confident that I can apply the knowledge I have gained to my career. ($\bar{X}$ = 4.77, S.D. = 0.55) And I like summarizing and reflecting on learning together, which helps to solve problems more accurately. ($\bar{X}$ = 4.76, S.D. = 0.47), respectively.

Conclusion

The research confirms the efficacy of Situation-Based Learning (SBL) as a pedagogical method to improve tendering skills among construction professionals. SBL closes the gap between theory and practice that has made standard professional training programs less effective by putting students in realistic and contextually rich situations. The favorable improvements in participants' skills and the stated satisfaction of learners provide empirical evidence for the significance and effectiveness of the SBL paradigm. The results have timely and actionable implications for industry stakeholders, including construction associations, training providers, and corporate learning and development departments. They indicate the necessity for a transformation in training design, shifting from traditional lectures to more engaging and immersive learning opportunities. Investing strategically in scenario development, facilitator training, and partnerships for project collaboration is likely to lead to big and long-lasting improvements in the skills of the workforce. As China's construction sector modernizes and its population changes, SBL is a very timely learning approach. It helps young professionals entering the field learn important skills and knowledge faster, and makes it easier for older people to pass on their knowledge to younger people. As the tendering process gets more complicated, future versions of SBL could include technology and sustainability in the scenarios. The study not only provides a verified instructional design but also empirical evidence advocating for the integration of experiential learning as a fundamental component of professional development in the construction sector.

Discussion

The current study provides substantial empirical evidence for the premise that a Situation-Based Learning (SBL) intervention can significantly enhance the tendering capacity of construction professionals. The very large effect size ($d = 3.60$) shows that the difference was not only statistically significant but also important in the real world. This is because it shows a big change in the participants' level of competency, going from a low pretest mean to a posttest mean where 70% of the participants were considered "excellent." This outcome highlights the potentially transformative influence of SBL on the cultivation of intricate professional competencies. The success of this intervention can be ascribed to the application of fundamental tenets of Situated Learning Theory, which asserts that learning is most efficacious when situated in a genuine situation. The use of immersive simulations and real-life site visits established a real community of practice where the participants could take part in peripheral activities that were quite similar to apprenticeships. For example, the role-playing activities forced the trainees to make decisions about cost, quality, and risk in real time. The site visits, on the other hand, let them see how the tender documents fit into the real world by showing them how they would be used in their physical and operational context. By including knowledge as a fundamental aspect of its application, the intervention

addresses a significant shortcoming of conventional training programs, which sometimes exhibit an ambiguous relationship between theoretical instruction and practical implementation. Based on the literature, the current findings not only support previous studies on the effectiveness of situational learning and problem-solving, like Liu et al. (2024), but also enhance our comprehension of the optimal strategies for imparting intricate professional skills, such as construction tendering. The participants' high level of satisfaction, especially regarding enhanced problem-solving abilities and perceived relevance for career progression, underscores the significance of adult learning theory concepts in boosting learning motivation. Knowles (1984) says that adults are usually more interested in learning when they think the content is useful for their personal and professional goals, when they have some say in how they learn, and when they can use what they learn right away in real life. Moreover, the intervention seems to be particularly effective for an elderly construction workforce. SBL made it possible for people of different ages to share information. More experienced professionals shared their implicit, practice-based knowledge during the scenario work and site visits, while younger trainees brought digital skills, new ways of analyzing data, and technologies. This synergy indicates that SBL could function as a specific mechanism for knowledge retention during periods of workforce demographic transition. It is important to keep in mind some cautions when interpreting these results. First, the quasi-experimental pretest–posttest design precludes a clear causal assertion, as other influences, including the effects of general training exposure or practice effects associated with retesting, cannot be entirely excluded. Second, the sample was restricted to a convenience group from a particular regional setting, which slightly constrains the external validity of the results. Third, the study only looked at the short-term effects of the intervention. A better approach would have looked at how well the knowledge and abilities were retained over time and how well they were used on the job. Future research should rectify these limitations by evaluating the efficacy of SBL against conventional training methods through randomized controlled trials and by monitoring performance metrics over an extended duration to determine the sustainability of learning gains and their impact on job performance. It may also be beneficial to examine the relative contributions of individual components of the SBL intervention (e.g., simulations, site visits, and collaborative tasks) to identify the variables that most significantly enhance learning results.

Recommendations

Recommendations for Implementation

Situation-based learning should continue to be integrated into technical training programs, particularly in areas related to construction and project management, as it enhances practical skill development and decision-making abilities.

The duration of training programs should be extended, or training modules should be

distributed over longer periods to allow participants sufficient time for deeper engagement, reflection, and knowledge consolidation.

Training programs should incorporate a broader range of case studies that represent various types of construction projects and different levels of bidding complexity in order to better reflect real-world industry situations.

Supporting learning materials should be further developed and improved, including practical templates, checklists, and video demonstrations, to facilitate both pre-class preparation and post-class review.

Recommendations for Further Research

Future research should conduct comparative studies between situation-based learning and other active learning strategies, such as problem-based learning (PBL), to evaluate their relative effectiveness in professional training contexts.

Subsequent studies should expand the sample size and include participants from diverse construction regions and industry sectors in order to improve the generalizability of the findings.

Further investigation should examine the long-term retention of knowledge and skills acquired through situation-based learning approaches.

Researchers should explore the development of digital or hybrid situation-based learning platforms to enhance accessibility, flexibility, and scalability of training programs.

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