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Exploration of Outcome-Oriented Situated Knowledge Co-Construction in Classroom Teaching Design

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Abstract

Against the backdrop of the new economic era, addressing the issues of how teachers should teach, how students should learn, and how to cultivate talents needed by enterprises has become a pressing concern problem in higher education reform. This paper takes the course "Intelligent Product Styling Design" as a case study and conducts practical design experiments in the new classroom teaching model. Grounded in constructivist theory, the teaching design proposes an outcome-oriented approach to situated knowledge co-construction in the classroom, transforming intended knowledge points into carefully designed class activities or mini projects. Students are then guided to reconstruct the corresponding knowledge points through their participation in these activities. Through two transformative stages, the design facilitates knowledge construction and skill development, achieving improved teaching effectiveness, better learning experiences, and greater learning outcomes, all leading to more efficient attainment of educational objectives. Results indicate that, under the outcome-oriented situated knowledge co-construction classroom design, student works exhibit higher innovation, and there are more patent authorizations, academic paper publications, participation in competitions, and enhanced learning experiences compared to traditional teaching methods. This suggests that the new classroom teaching model can significantly enhance learning efficiency, contribute to the cultivation of new talents, and holds substantial reference value.

Keywords: outcome-oriented, situated knowledge co-construction, classroom teaching design, teaching design practice, constructivist theory

1. Introduction

In the wake of societal and technological advancements, numerous industries are undergoing profound transformations. This shift has given rise to new challenges in higher education, particularly in the realm of talent development. Firstly, the rapid evolution of internet technology has rendered knowledge and information omnipresent, offering students diverse and swift avenues to acquire information. Consequently, teachers are no longer the exclusive or primary source of knowledge in the classroom. This prompts the crucial inquiry: what defines the value of teachers in the context of classroom teaching? Secondly, the acceleration in the iteration of knowledge and technology has led to explosive growth, surpassing the pace at which knowledge is transmitted in the classroom. Hence, the question emerges: what should students learn in the classroom? Additionally, the ongoing technological revolution is rapidly steering industrial transformations, fostering new formats and models. Traditional modes of talent cultivation may no longer suffice for the evolving demands of the new economy. This brings forth the question: what kind of talents do enterprises currently require? The essence of these three questions revolves around aligning teaching and learning with enterprise needs. Consequently, research is essential to understanding how teachers should teach and how students should learn in the context of higher education.

Several universities have undertaken extensive research to address these pressing questions. The Gao Ruiyou’s team at Central South University of Forestry and Technology posits that in the contemporary era, teaching models should be designed to enhance students' individual learning and foundational capabilities. This approach aims to cultivate a new breed of talent capable of meeting enterprise demand. They advocate for an integration of theoretical analysis with practical research in teaching s(Gao, 2020). Wang Lihua's team at Shandong University of Science and Technology, cognizant of the talent requirements in electronic enterprises, suggests that the new curriculum teaching system should focus on fostering students' innovative abilities. This is implemented through innovative talent cultivation systems, such as collaborative education and innovations in professional systems(Wang, et al., 2020). Yu Yazhou's team at Xi'an University of Finance and Economics, guided by the STEAM education philosophy, proposes measures to implement interdisciplinary interactive teaching methods(Yu,2020). These studies primarily focus on developing new training models based on innovative teaching concepts, which to some extent, facilitate the cultivation of innovative talents. The emphasis lies in aligning with industry needs, understanding enterprise talent requirements (Question 3: What talents do enterprises need?), and adopting advanced teaching philosophies to establish teaching models with capabilities as the output. However, there is a noticeable scarcity of research on the specific implementation of this training model in classroom teaching (Question 1: How do teachers teach in the classroom? Question 2: How do students learn in the classroom?). In practice, the efficacy of all quality talent cultivation programs hinges on well-crafted classroom teaching designs and activities conducted within the classroom(Bie, 2019). Thus, classroom teaching emerges as the pivotal factor influencing talent cultivation. Consequently, transforming the traditional classroom teaching model into an outcome-oriented one, constructing a modern classroom teaching system by redefining the learning environment, methods, and activities, is conducive to enhancing students' initiative, interaction, and interest in learning. Ultimately, this leads to the efficient cultivation of new talents.

2. Construction of Classroom Teaching Design System

2.1. Traditional Classroom Teaching System

According to the study done by Bai Mengni, Hong Zhizhong and Wu Libao, they indicates that in this teaching model, teachers efficiently convey knowledge, but students find it challenging to comprehend, receive, and internalize a substantial amount of information within a short timeframe (Bai,2017), (Hong, 2019), (Wu, 2019). Additionally, a singular cultivation approach hampers the development of students' creative thinking, hands-on practices, and communication skills. Only a minority of students engage in effective interaction in the classroom, leaving the majority passively receiving information and resulting in insufficient development of their capabilities and lower learning efficiency.

To better align with the educational requirements of the modern era, there is a critical need to construct a more flexible and innovative classroom teaching design system. This system should encourage active student participation in the learning process, fostering the development of new talents equipped with practical skills and innovative thinking.

2.2. Classroom Teaching Design Methods

This paper introduces an outcome-oriented teaching paradigm that emphasizes the improvement of classroom efficiency, the accomplishment of student knowledge co-construction, and the enhancement of skills through deliberate classroom teaching design. Rooted in constructivist theory, this teaching paradigm places students at the center, emphasizing their active exploration, discovery of knowledge, and the proactive construction of the meaning of learning.

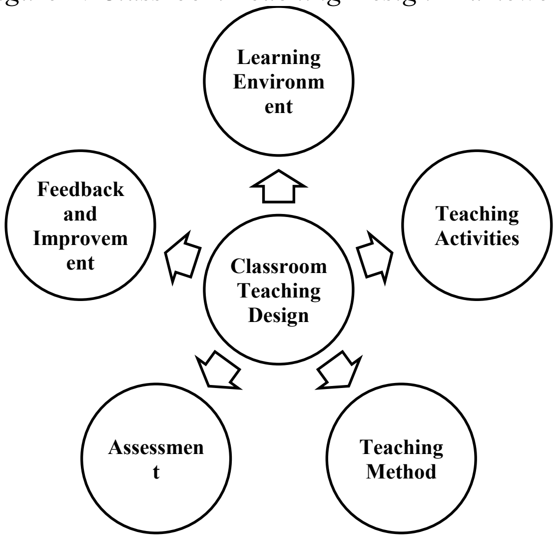
In the concrete implementation of the new classroom teaching, the design of classroom content revolves around outcome goals and the novel structure of knowledge, skills, and competencies. Throughout this process, the student-centered approach and the emphasis on proactive learning become prominently evident. Consequently, the envisaged classroom design framework is depicted in Figure 1.

2.2.1. Designing the Learning Environment

The learning environment constitutes a pivotal aspect of students' classroom learning experiences, exerting a significant influence on their overall learning efficiency (Lu & Yang, 2008). Comprising four essential elements – context, collaboration, conversation, and meaning construction – the structure of the learning environment begins with students internally constructing a psychological learning atmosphere. This is then outwardly expressed through the norms and cohesion of the learning community, shaping the external manifestation of the classroom's learning ambiance. A positive classroom learning atmosphere is closely intertwined with heightened learning effectiveness.

When considering student outcomes, a conducive learning environment positively impacts students' cognitive development, emotional growth, exploration of interests, and creativity. Within this project, the classroom environment system encompasses the physical environment, resource learning environment, technological learning environment, and emotional learning environment.

Figure 1: Classroom Teaching Design Framework



Source: (CDIO 12 standards)

2.2.2. Designing Learning Methods

At the core of the learning process lies the social nature of knowledge, where construction is achieved through exploration, interaction, and practical engagement (Neşe & Murat, 2018). In the design of classroom learning methods, referencing the research findings from the Maine National Training Laboratory for Applied Behavioral Science - the Active Learning Pyramid (as depicted in Figure 3) reveals that adopting learning approaches such as discussions, practical exercises, and teaching others results in an impressive 90% knowledge retention rate two weeks later (Shi & Lu, 2015). Consequently, embracing an active learning model emerges as an effective strategy for realizing the co-construction of contextual knowledge.

2.2.3. Designing Classroom Teaching Activities

The design of classroom teaching activities involves transforming the knowledge points planned by the teacher into interactive classroom tasks, enabling students to reconstruct the relevant knowledge points through their participation. This constitutes the core and challenging aspect of classroom teaching design. When crafting classroom teaching activities, the use of teaching methods aligns with the Active Learning Pyramid model, as outlined in Table 1.

Table 1: Design of Situational Knowledge Co-construction and Learning Modes

Teaching Methods	Learning Modes
Project-Based	Active Learning Model
Task-Driven	
Problem-Oriented	
Case Analysis	

Source: (CDIO 12 standards)

2.2.4. Designing the Evaluation Mechanism

In classroom design, the evaluation mechanism for students stands as a pivotal indicator of learning quality and a crucial element in course design. The sense of achievement experienced by students throughout the learning process significantly influences their motivation for sustained learning and ultimately shapes the learning outcomes (Sun et al., 2012). For learning communities, factors such as team honor and individual contributions to the team become pivotal in motivating learning and determining its quality. Thus, diverging from the traditional classroom teaching approach that relies solely on paper-based assessments, the new classroom design encompasses assessments from four dimensions: process evaluation, outcome evaluation, team evaluation, and individual evaluation.

Building upon the established classroom teaching design system and considering the unique characteristics of the Chengdu campus at the University of Electronic Science and Technology of China, this study focuses on four dimensions in the classroom teaching design plan: learning environment, learning methods, learning activities, and evaluation mechanism.

3. Implementing Measure

3.1. Implementation Measures for Learning Environment

Following the classroom learning environment design method, specific measures are taken in designing the physical learning environment, resource learning environment, technological learning environment, and emotional learning environment. The detailed measures are outlined in Table 2.

Table 2: Implementation Measures for Classroom Learning Environment

Environment Type	Implementation Measures
Physical Learning Environment	Implement an innovative classroom layout, transforming it into a space where group members can discuss and interact, fostering communication between groups.
Resource Learning Environment	Tailor learning resources based on the content of different majors, including essential materials like slides, discussion materials, and other resources. Utilize online platforms to disseminate slides, literature, videos, and other relevant resources for both online and offline interaction.
Technological Learning Environment	Establish an online platform for the course, ensuring a modernized classroom with efficient technological integration.
Emotional Learning Environment	Create learning scenarios involving group assignments, discussions, and competitions. With effective motivation, enhance students' team pride and learning confidence.

Source: (Author’s own work)

3.2. Implementation Measures for Learning Methods

In the design of the four classroom scenarios, the specific implementation measures are based on the active learning mode. This encompasses problem-oriented approaches, fishbowl discussions, role-playing, group interactive learning, flipped classrooms, debates, etc.

3.3. Implementation Measures for Classroom Teaching Activities

3.3.1. Determination of Learning Levels

In designing learning activities, the initial step involves defining the teaching objectives for the class. This study employs Bloom's Taxonomy of Educational Objectives to establish the classroom teaching goals (Sun et al., 2019). The specific implementation measures include:

(1) Analyzing the knowledge points and teaching objectives for the class session.

(2) Applying Bloom's Taxonomy to categorize the cognitive domain levels of the class knowledge points, encompassing knowing, understanding, applying, analyzing, synthesizing, etc.
(3) Based on the identified learning levels, preliminary determination of the learning activities.

3.3.2. Tailoring to Students' Learning Styles

Based on the Learning Circles theory, recognizing the diversity in students' learning styles is imperative. Consequently, when crafting classroom teaching activities, selecting types of activities that align with students' unique characteristics can significantly enhance learning efficiency. In practical application, the KOLB learning style test is employed to assess students' individual learning styles and formulate a model that serves as the foundation for activity design (Shi, 2018).

3.3.3. Attention Modulation Principle

Within the framework of classroom design, the effective allocation of time emerges as a critical factor. A well-thought-out time structure can sustain students' concentration at elevated levels, ultimately augmenting the effectiveness of the learning process. Therefore, in the specific blueprint for classroom time management, the attention principle is implemented to design time segments, adhering to the 90-20-8 principle for each instructional phase (Li, 2017).

3.3.4. Ability Training and Student Outputs

Each learning activity is tailored with a clear objective for honing specific abilities and generating corresponding student outputs, representing their learning achievements. Consequently, prior to formulating learning activities, educators must delineate the abilities students should develop and the correlated outcomes to serve as evaluation benchmarks for the activity. This approach underscores student outcomes as the guiding compass for activity design, thereby achieving a scenario-based co-construction of knowledge course design. Taking the instance of innovation skills training, student outputs are outlined in Table 3.

Adhering to the outcome-oriented design principle in course creation, which mirrors the distinctive features of ability training and student outputs, the procedural steps involve:

(1) Defining training prerequisites for student abilities and specifying student output formats based on the teaching goals;
(2) Aligning the knowledge learning hierarchy with student outputs, discerning the level of mastery required for students in this class to attain the desired design outcomes;
(3) Preliminary selection of diverse activity forms contingent on expected outcomes;
(4) Aligning students' learning styles based on the KOLB learning style model;
(5) Finalizing the activity types;
(6) Infusing ability training into pertinent segments. For instance, during group discussions, emphasis is placed on cultivating students' communication and expression prowess; during the conceptualization of creative product solutions, the focus is on fostering students' innovation skills;
(7) Putting teaching activities into practice and refining them. Implementing designed activities in the classroom setting, with adjustments and enhancements based on students' learning dynamics.

Table 3: Training of Innovation Skills and Student Outputs

Skills Training	Teaching Activity	Student Outputs (Skill Demonstration)			
Innovation Skills	Creative Product Design Concept	Level I Output: Sketch and report of creative solutions	Level II Output: Detailed design model of creative solutions	Level III Output: Patent authorization for creative solutions, published papers, and awards in technology competitions	Level IV Output: Successful entrepreneurial implementation of creative solutions

Source: (Author's own work)

3.4. Evaluation Mechanism

Within the framework of classroom design, the effectiveness assessment serves as the benchmark for determining the rationality of the classroom design. It is also a crucial reference indicator for information feedback and refining classroom design schemes. The evaluation system design process involves:

(1) Total Coefficient Allocation: Establishing the total coefficient for process assessment and result assessment as 1 based on the overall objectives of the course and the teaching goals for each class session. Coefficients are proportionately assigned based on the characteristics of the course.
(2) Team and Individual Assessment: Setting the total coefficients for team assessment and individual assessment as 1. Coefficients are allocated based on the characteristics of learning activities.
(3) Process and Result Assessment Indicators: Initiating the process by defining indicators for process assessment (e.g., interim reports, student defense expressions) and result assessment indicators (constructed models, physical prototypes, reports, etc.) from the perspective of students' learning experience.
(4) Team and Individual Assessment Indicators: Defining team assessment indicators (overall completion of projects, quality of work, etc.) and individual assessment indicators (task logs for individual roles, oral expressions, sharing of solutions, etc.).

4. Classroom Teaching Design Practice for Learning Environment and Scenario-Based Co-construction of Knowledge

This study utilizes the course "Intelligent Product Styling Design" as a case for teaching design practice, targeting undergraduate students majoring in intelligent systems from the academic years 2016 and 2017 at our institution. The experimental group consists of 85 students from the 2017 cohort, divided into 20 learning groups. The control group comprises 96 students from the 2016 cohort, organized into 22 learning groups. The research spans two semesters. For the 2017 experimental group, classroom teaching design is implemented based on specific measures in the four aspects: learning environment, learning styles, learning activities, and evaluation mechanisms. The 2016 control group receives traditional theoretical courses and practical sessions in a binary system.

4.1. Student Outcomes

After two semesters of implementing the course, the quantity of creative works from both the experimental and control groups is compiled. Assessment is conducted based on Archibald's innovation level standards[15]Comparison of creativity levels in works between two groups, an analysis of the creativity levels in works produced by the two groups reveals noteworthy distinctions. The results underscore two key observations:

(1) Regarding the creativity exhibited in student works, the experimental group (comprising 2017-level student groups) demonstrated a markedly higher number of works with elevated creativity levels (II and III) following the implementation of the new course design, compared to the control group (2016-level) undergoing traditional teaching methodologies. This highlights the clear superiority of the new classroom teaching design in stimulating higher-level creativity among students.

(2) Within the experimental group, there was a discernible increase in the ratio of creativity across levels I, II, and III. This rise was particularly pronounced in the II and III levels (Zhou & Chen, 2015). The innovative classroom teaching design proves to be more conducive to fostering advanced student creativity.

These findings suggest a positive impact of the novel classroom teaching design on eliciting higher-level creative outputs from students, surpassing the outcomes achieved through traditional teaching approaches.

Table 4: Comparison of Student Creative Works

Grade	Level I	Level II	Level III
2016	12	8	2
	(54.5%)	(36.4%)	(9.1%)
2017	6	10	4
	(30%)	(50%)	(20%)

Source: (Author's own work)

4.2. Student Experience

The goal of classroom teaching design extends to the creation of a positive learning experience. Consequently, student experience serves as a crucial evaluation metric. This aspect is primarily assessed through a questionnaire survey, covering five key dimensions: skill cognition, teaching strategies, ability integration, evaluation methods, and overall learning experience, as outlined in Table 5.

Table 5: Partial Questions from the Questionnaire Survey

Dimension	Questions
Skill Cognition	1. During the course, I believe my communication skills received systematic training.
	2. In various learning activities, I feel that my teamwork skills have greatly improved.
Teaching Strategies	1. Various team learning activities conducted in class make me feel that knowledge construction is quite effective.
Ability Integration	1. In the course's project practice, I believe my ability to integrate knowledge significantly improved in product design.
	2. In the comprehensive project practice of the course, I believe my ability to identify and solve problems has improved significantly.
Evaluation Mechanism	1. I think the staged evaluation of learning activities is highly motivating for me.
Learning Experience	1. Engaging in online interactions, group discussions, and debates in class, I find my interest and participation levels are high.

Source: (CDIO 12 standards)

Using the Likert scale method, the acceptance of each question is defined on a scale of five levels, namely: strongly disagree, disagree, neutral, agree, and strongly agree (Yin, 2019). Starting from strongly agree, each level corresponds to a score of 5, 4, 3, 2, 1.

For the control group and experimental group, one class was selected for each group, with 25 students in each class. The results are presented in Table 6.

Table 6: Survey Results

Dimension	**Research Questions for Each Dimension**	**Experimental Group - 2017 (Number of Students)**					**Control Group - 2016 (Number of Students)**				
		1	***2***	***3***	***4***	***5***	***1***	***2***	***3***	***4***	***5***
Skill Cognition	Question 1	1	1	2	13	8	4	5	8	6	2
	Question 2	4	3	4	7	7	6	6	6	3	4
Teaching Strategy	Question 1	2	2	3	9	9	6	7	5	5	2
Integration of Abilities	Question 1	4	3	5	7	6	10	7	3	4	1
	Question 2	1	2	6	9	7	6	6	8	3	2
Evaluation Mechanism	Question 1	3	3	4	8	7	5	5	5	6	4
Learning Experience	Question 1	1	1	1	12	10	5	4	8	5	3
	Question 2	3	2	5	10	5	6	2	10	6	1

Source: (Author's own work)

Due to space limitations, only the answers to the dimensions of 'Agree' and 'Strongly Agree' are summarized. The specific data is shown in Tab. 7.

Table 7: summarizes the questionnaire data

Dimension	**Research Questions for Each Dimension**	**Experimental Group - 2017**	**Control Group - 2016**
		The percentage of students who 'Agree' and 'Strongly Agree'	
skill Cognition	Question 1	84%	32%
	Question 2	56%	28%
Teaching Strategy	Question 1	72%	28%
Integration of Abilities	Question 1	52%	20%
	Question 2	64%	20%
Evaluation Mechanism	Question 1	60%	40%
Learning Experience	Question 1	88%	32%
	Question 2	60%	28%

Source: (Author's own work)

Analyzing the responses across the five dimensions, it is evident that students in the experimental group (2017) exhibit a notably high level of satisfaction with their learning experience. A substantial 84% of students acknowledge improvements in their skills, and an impressive 88% express satisfaction with their overall learning journey. In various aspects such as teaching strategies, evaluation mechanisms, and other facets of classroom instruction, students in the experimental group demonstrate elevated satisfaction levels, with only the ability integration dimension showing a relatively lower recognition (52%, still significantly higher than the control group's 20%). In contrast, students in the control group (2016) display lower satisfaction levels across different dimensions, indicating a general dissatisfaction with their learning outcomes. Consequently, it can be inferred that the experimental group (2017), following the implementation of the classroom design method, exhibits a higher overall satisfaction with the learning experience compared to the control group (2016). This suggests that the classroom design has effectively enhanced students' learning experiences and satisfaction, aligning with the intended objectives.

5. Conclusion

The study employs the 'Intelligent Product Styling Design' course as a case study, applying the scenario-based knowledge-building concept to optimize the final implementation step of talent cultivation – the 45-minute classroom session. The research explores methods and implementation measures for classroom design across five key aspects: learning environment, teaching activities, teaching methods, evaluation, and feedback. The result is the creation of high-quality classrooms that align with knowledge levels, accommodate diverse learning styles, ensure high participation rates, and deliver a positive overall learning experience. This approach motivates students to generate innovative solutions, produce reports, academic papers, and patents. In terms of learning outcomes, students exhibit a significant improvement in innovation capabilities and generate a more diverse range of outputs compared to traditional teaching methods. Concerning the student learning experience, the new classroom design philosophy leads to higher satisfaction levels, successfully achieving the intended objectives. Therefore, future work could focus on further refining the existing classroom design to continuously optimize the teaching approach.

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References

Bai, M. (2017). Comparative Study on Traditional Classroom and Flipped Classroom Teaching Models in Higher Education, China University of Geosciences, China :Beijing .

Bie, D. (2019). The Main Tasks, Key Points, Difficulties, and Breakthroughs of the University Classroom Revolution, *China Higher Education Research*, vol. 6, pp.1-7.

Hong, Z. (2019). Learning Transformation in University Classroom Reform, *China Higher Education Research,* vol. 6, pp. 15-20.

Li, Y. (2017). Discussion on Grasping the Teaching Rhythm from the Perspective of Psychology, *Teaching and Management*, vol. 33, pp. 99-101.

Lu, G. and Yang, Z. (2018). A Review of Research on Learning Environment and Student Development, *Comparative Education Research,* vol. 7, pp. 1-6.

Neşe, K. A. and Murat, G. (2018). The Effect of Differentiated Science Curriculum on Students' Motivational Regulations, *ResearchGate*, Vol.6, vol. 3 ,pp. 455-465.

Shi, G. (2018). Research on the Presentation Mode of Resources Based on the Learning Styles of College Students, Zhejiang Normal University, China: Hangzhou.

Shi, Q. and Lu, K. (2015). Application of the Learning Pyramid Theory in Small-Class Teaching of "Introduction to Urban Rail Transit.", *Experimental Technology and Management*, Vol.32, vol. 5, pp. 225-226, 244.

Sun, J., Mao, W. and Li, C. (2019). Deconstruction and Cultivation of Core Competencies of Engineering and Technical Talents: Based on Bloom's Educational Objective Classification, *Research on Higher Engineering Education*, vol. 5, pp. 97-102, 114.

Sun, R., Shen, R. and Guan, L. (2012). Research on Factors Affecting the Learning Effect of College Students, *Journal of the National Academy of Education Administration*, vol. 9, pp. 65-71.

Wang, L., Zeng, Q. and Li, C. (2020). Cultivation Mode of Scientific and Technological Innovation Ability for Students in Electronic Information Major Under the Background of New Engineering, *Experimental Technology and Management*, vol. 2, pp. 24-27.

Wu, L. (2019). On the Holistic Transformation of Undergraduate Education: A Perspective Shift from "Teaching Paradigm" to "Learning Paradigm" Based on Knowledge Paradigm Transformation, *China Higher Education Research*, vol. 6, pp. 65-71.

Yin, W. (2019). Construction of a Course Evaluation System for College Foreign Language Flipped Classroom Based on CIPP, *Journal of Ocean University of China (Social Sciences)*, vol. 3, pp. 121-128.

You, G. (2020). Research on Teaching Reform Based on the Cultivation of Abilities in the Major of Human Resources Management, *Contemporary Education Practice and Teaching Research*, vol. 1, pp. 57-58.

Yu, Y. (2020). Cultivation of Innovative Ability of Applied University Students Based on STEM Education Philosophy, *Chinese and Foreign Entrepreneurs*, vol. 5, pp. 195-196.

Zhou, S. and Chen, M. (2015). *Innovative Thinking and TRIZ Innovation Method*, Tsinghua University Press, Chian: Beijing.