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Enhancing feedback mechanisms in medical education: insights from clinical instructors in a Taiwanese medical center

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Abstract

Objective This study aimed to evaluate clinical instructors' agreement with and the effective implementation of the Objective Structured Clinical Examination (OSCE) in a medical center in Taiwan.

Methods Clinical instructors qualified as examiners at the designated medical center were surveyed using a stratified random sampling technique. A total of 287 valid responses out of 350 questionnaires distributed were collected, yielding an 82% response rate. Descriptive statistics, independent sample t-tests, one-way ANOVA, and Pearson correlation analysis were employed for data analysis.

Results The findings indicated that clinical instructors generally supported and demonstrated proficiency in the OSCE. Moreover, those who had participated in more scoring activities and received faculty training in the past three years showed stronger alignment with the OSCE and greater effectiveness in its implementation. A moderate to high positive correlation was found between instructors' endorsement of the OSCE and their successful execution of it.

Conclusions The results underscore the importance of clinical instructors' endorsement and proficiency in OSCE implementation. These findings hold significance for medical education administrators, clinical instructors, and future research endeavors in medical education, aiming to enhance instructional quality.

Keywords Medical education, Objective structured clinical examination (OSCE), Clinical instructors, Agreement

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Introduction

In the evolving healthcare landscape, patient needs are constantly changing, necessitating improvements in medical education to enhance healthcare quality and patient safety. Medical education assessment now emphasizes a patient-centered approach, focusing not only on knowledge but also on skill training and attitude development. To move beyond rigid classroom teaching and written exams, the Objective Structured Clinical Examination (OSCE) has emerged as a key reform in Taiwanese medical centers and a global trend in licensing examinations for healthcare professionals [1]. Introduced by Harden and Gleeson in 1975, OSCE utilizes standardized patients (SPs) in structured clinical scenarios to evaluate essential competencies such as history-taking, physical examination, communication, and patient education. This method ensures competency-based learning outcomes, clinical proficiency, and serves as a reference for instructional improvement [2]. Recognizing its effectiveness, Taiwan incorporated OSCE into the National Medical Licensing Examination. Since 2003, the Taiwan Association of Medical Education has collaborated with national agencies to implement the "Clinical Skill Assessment Test Program," establishing OSCE sites in medical schools and teaching hospitals. By 2019, 26 hospitals were actively engaged in this initiative [3].

In recent years, various training hospitals entrusted with implementing the "Clinical Skill Assessment Test Program" by the Taiwan Association of Medical Education have been facing the impact of lack of funding. Hospitals need to maintain the quality of OSCE execution using self-generated resources. As a result, it has been observed that the number of participants in examiner training courses organized by hospitals has been decreasing year by year. Although OSCE implementation has been widely studied in Western countries, there remains a gap in understanding its acceptance, effectiveness, and sustainability in Taiwan, particularly in the context of diverse medical professions beyond physicians. This study aims to address this gap by exploring the perspectives of clinical educators across multiple disciplines on the acceptance and implementation of OSCE.

To investigate this, it is necessary to first understand the current level of recognition and implementation of OSCE. Beyond the practical implementation and execution of training, there is a need for investment in terms of financial resources, time, and manpower. Properly utilizing these limited resources to identify issues will help transform training from being seen as an unnecessary expenditure to an important investment. This investment can lead to improved student learning outcomes and faculty development, ultimately enhancing the quality of teaching. A key strength of this study is its comprehensive examination of clinical educators' perspectives across different professional backgrounds, which has not been extensively explored in previous OSCE-related research. By identifying factors that influence OSCE acceptance, this study provides valuable insights into optimizing faculty training and resource allocation to enhance medical education effectiveness.

As medical education evolves, educators must continually enhance their teaching and professional skills to integrate new knowledge into practice [4]. Expanding the pool of OSCE examiners across various professions requires regular faculty training to strengthen understanding of the assessment method. A medical center in Taiwan has implemented OSCE in over ten medical technology fields beyond Western and traditional Chinese medicine and dentistry. However, limited awareness of curriculum quality and faculty training effectiveness necessitates further investigation. This study examines how clinical educators from different backgrounds perceive and accept OSCE, focusing on factors influencing examiner training participation and sustainable implementation in Taiwan.

Literature review

Objective Structured Clinical Examination (OSCE) in Taiwan

The Objective Structured Clinical Examination (OSCE), introduced by Ronald Harden in 1975, is an assessment method in medical education using multiple thematic stations. Examinees rotate through stations, demonstrating clinical skills within a set time, assessed by an examiner. OSCE evaluates history taking, physical examination, diagnosis, communication, and other competencies beyond written exams [5]. As OSCE became integral to national medical licensing exams worldwide, Taiwan established a promotion team in 2004. After a phased implementation involving government and medical institutions, OSCE was officially incorporated into Taiwan's national medical licensing examination in 2013 [6].

The OSCE is an assessment tool based on objective and standardized principles. Candidates go through a series of timed stations in a circuit, where they undergo professional performance evaluations in simulated environments. Trained instructors serve as scoring examiners at each station, following standardized scoring sheets for assessment [7]. Based on Miller's Pyramid theory, OSCE effectively measures learners' ability to perform clinical tasks, making it a widely used clinical skills assessment method [8]. It integrates summative and formative assessment approaches, offering standardization, objectivity, and bidirectional feedback [9]. Summative OSCEs assess competency for certification or promotion, while formative OSCEs identify learning gaps and provide feedback to enhance instruction. Instructors frequently use the formative approach to evaluate interns and new staff, refining training based on observed progress [10].

The OSCE assesses learners' clinical skills in simulated scenarios. Its advantages lie in the ability of the examiners to standardize the content of the assessment and control the clinical situations of the test questions. It is suitable for critical conditions, rare cases, complex clinical situations, and interdisciplinary cooperation, unlike methods such as mini-CEX and DOPS. In clinical medical education, a patient-centered approach emphasizing skill training and attitude cultivation is gaining importance. This shift seeks to overcome the limitations of traditional didactic methods and paper-based assessments, which cannot fully measure clinical abilities. OSCE offers key benefits: (1) controlled, standardized environments prevent medical errors, (2) it aligns curriculum and assessment for efficient teaching and evaluation, and (3) standardized patients can be reused for assessment and feedback [11].

Designing and planning an OSCE assessment requires extensive preparation, including arranging clinical skills center equipment, preparing instructional materials, training examiners and standardized patients, conducting the OSCE assessment, and conducting post-assessment reviews. This process demands a significant amount of human and material resources. It also involves personnel costs, including training fees for OSCE examiners and standardized patients, as well as attendance fees [12]. While the implementation of OSCE in Taiwan has been supported by government agencies, economic costs and human resource challenges remain, necessitating further improvements.

Agreement and related studies

Agreement refers to the psychological process of aligning one's thoughts or actions with a subject or concept, resulting in a harmonious convergence of vision and behavior [13]. It reflects a level of affiliation with the subject, manifested in seriousness, emotions, and actions. Some studies suggest that agreement involves the internalization of a subject's values, influencing an individual's thoughts, feelings, and behavior towards that subject [14]. Scholars also equate agreement with acceptance, describing it as a positive attitude and behavioral intention towards curriculum changes, as evidenced by teachers' research outcomes [15]. Taking into account the discussions of the scholars above, "agreement" is a process through which an individual, after social learning or socialization, gains awareness and understanding of things or entities, generating a subjective sense of approval within themselves. In this study, "agreement" refers to the subjective level of approval an individual holds after perceiving and comprehending a matter.

Based on the collection of relevant literature regarding agreement in education, instructional projects, or policy implementation, this study has summarized and analyzed the research and opinions of various experts and scholars. Reviewing the literature, "instructional administrative efficiency" was the most frequently addressed aspect, followed by "teacher professional development" and "teaching curriculum policies," with "student learning achievement" sharing the third position. Therefore, this study has chosen these four dimensions as the basis for designing the agreement questionnaire. Additionally, the revised scales on OSCE agreement for clinical instructors as formulated by Shun (2008) and Chen (2015) were referenced [13, 16], as explained below:

(1) Instructional Administrative Efficiency:
Instructional administrative efficiency refers to a hospital's ability to integrate internal and external resources, employ technological methods, systematic management, and effective leadership to support teaching. This enhances the overall medical quality and patient safety of the hospital, thus achieving educational objectives.

(2) Teacher Professional Development:
Teacher professional development refers to teachers actively and proactively engaging in various forms of learning and research throughout their teaching careers. This involves enhancing their teaching abilities, engaging in self-reflection and inquiry to elevate professional knowledge (cognition), strengthening professional attitudes, and improving teaching quality (skills). The aim is to meet students' learning needs and enhance their learning outcomes.

(3) Teaching Curriculum Policies:
Teaching curriculum policies involve the hospital designing specialized courses based on the clinical quality and patient safety of trained students or learners. These courses are grounded in the resources of students' clinical skills, hospital context, and occupational characteristics. The design aligns with the hospital's vision and curriculum philosophy, resulting in distinct courses tailored to different professions.

(4) Student Learning Achievement:
Student learning achievement refers to the growth or changes displayed by students during and after their learning processes. This includes an increase in knowledge (cognition), proficiency in skills (skills), and alterations in learning attitudes and motivation (affective). The goal is to enhance the level of enthusiasm for learning.

Implementation efficacy and related studies

OSCE has become a standard assessment in medical education, extending beyond medical doctors to other healthcare professionals. Teaching-oriented OSCE

involves direct observation by clinical instructors, peer review via video recording, and real-time feedback on clinical skills. This feedback helps students identify strengths and areas for improvement, enhancing the educational value of OSCE [17]. Effective OSCE planning requires meticulous preparation, addressing potential challenges like inadequate content, unclear instructions, or poorly trained standardized patients. It is essential to align assessment content with curriculum objectives to ensure consistency [18]. Clinical instructors must possess the necessary knowledge and skills to design and manage OSCE materials, balancing teaching, clinical duties, and OSCE-related workload [12].

This study, based on expert opinions and relevant literature on the application of OSCE, synthesizes and identifies the implementation effectiveness variables suitable for this research:

(1) Student Performance:
Research has shown that medical students who underwent external clinical experience before a second OSCE assessment showed significant improvement in treatment recommendations, with better accuracy and presentation compared to their first assessment without such experience [19]. An evaluation of doctor-patient communication skills in seventh-year medical students revealed commendable etiquette and attitudes, though there is room for improvement in professional knowledge and verbal precision [20]. A comparative study between conventional skill assessments and OSCE examinations found that while students more easily passed conventional assessments, OSCE was more comprehensive, appropriate, and impartial [21].

(2) Teaching Professionalism:
Research indicates that essential behaviors for clinical instructors include role modeling as exemplary learners, a sense of responsibility towards the profession, the ability to apply theory in clinical settings, and adept interpersonal relationships and communication skills. Being capable of providing correct and clear demonstrations to students, a clinical healthcare professional should embody the necessary professionalism, assisting newly entering healthcare personnel in delivering optimal patient care and addressing their queries. This involves applying theory to real clinical scenarios [22].

(3) Professional Dedication:
In education, teachers should uphold professionalism, adhere to ethical norms, and invest time and effort in students' learning and growth. A dedicated attitude is essential for overcoming challenges and fulfilling the mission of education [23]. Clinical educators, in particular, must adapt to the evolving clinical landscape and engage in self-directed learning for their professional development. The professional competence of clinical nursing educators includes a genuine interest in patient care, the integration of theory with practice, and the ability to serve as role models for students during internships [24].

Methodology

Research structure

This study aims to investigate the level of agreement and implementation effectiveness of OSCE among clinical instructors in medical centers. Through a review of relevant literature both domestically and internationally, the relationships among various variables were identified. Clinical instructor background variables are considered independent variables, and "agreement level" and "implementation effective-ness" are the dependent variables, forming the two main components. The research framework is depicted in Fig. 1.

Participates

This study targeted a total of 430 clinical instructors employed at a medical center in the year 2023, who met the criteria for examiner certification. The research utilized a questionnaire survey method, which was conducted in two stages: a pilot questionnaire and an official questionnaire. After undergoing validation through expert scrutiny and necessary revisions, the pilot questionnaire was used for the survey. To ensure the questionnaire's accuracy, a sample size of over 150 participants was necessary. During the factor analysis, the ratio of items to participants should be 1:5, and the total sample size should not be less than 100 to ensure the reliability of the results [25, 26]. Therefore, the pilot questionnaire of this study aimed to include a sample size of 150 participants. For the pilot questionnaire, the researchers employed a stratified sampling approach based on the size of the target population's occupational categories. The sample size for each occupational category was determined based on the percentage of clinical instructors in each category at a certain medical center. The sampling method used was purposive sampling.

Following item analysis and reliability analysis, the pilot questionnaire was refined to create the official questionnaire. To ensure the convenience of the study and consider sample representativeness and response rate, the researchers used a "stratified random sampling" approach for the official questionnaire. Strata were defined based on the occupational categories' size, with the sample size for each category determined by the percentage of clinical instructors in each category. Gay and Airasian (2003) recommended that the formal sample

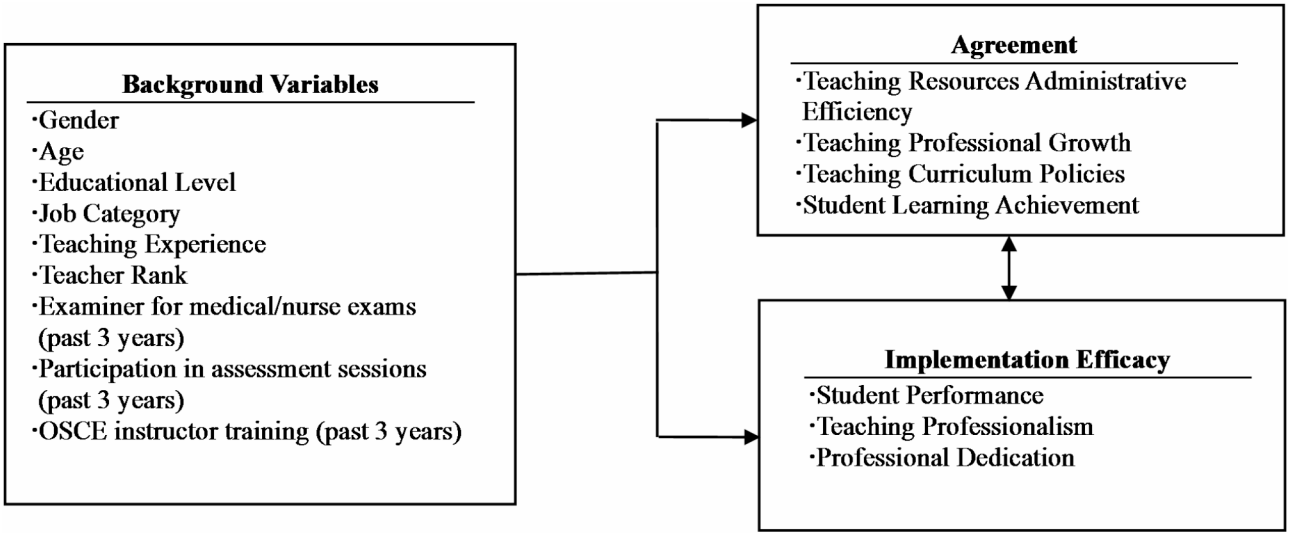

Fig. 1 Research structure

size for questionnaire surveys should be at least 10% of the target population [27]. When the target population is relatively small, a formal sample size of over 20% of the target population is appropriate [25, 26]. Based on these considerations, this study set the formal questionnaire sample size at 350 participants, and the sampling would be conducted using proportional random sampling.

Research tools

This study employed a questionnaire survey method to collect relevant demographic information. Using the literature review and research framework as references, a preliminary draft of the pilot questionnaire was created. To enhance the construct validity and reliability of the research instrument, item analysis and Cronbach's α coefficient testing were conducted using the statistical software SPSS after implementing the pilot questionnaire. This aimed to evaluate the reliability and validity of the research tool.

After the questionnaire content was reviewed and revised by experts in the field of medical education, it was refined and compiled into the official questionnaire. The content of the official questionnaire consisted of three parts: the first part covered "Basic Information of Clinical Instructors," the second part included the " Clinical Instructors' Level of Agreement with OSCE " with a total of 23 items, and the third part encompassed the "Clinical Instructors' Perception of the Implementation Effectiveness of OSCE" with a total of 14 items. The survey questionnaire used a Likert-type five-point scale for responses. Clinical instructors were asked to provide their own real-life responses to the questions related to their perceived acceptance and implementation effectiveness of OSCE. Respondents selected the option that closely matched their feelings and experiences from the five response categories: "Strongly Agree," "Agree," "Neutral," "Disagree," and "Strongly Disagree." These options were assigned scores from 5 to 1, respectively.

Data processing

After conducting the questionnaire survey in this study, the collected valid questionnaire data were archived and coded. Statistical analysis of the data was performed using the SPSS software. Initially, descriptive statistics were used to analyze the distribution of background information within the research sample, including frequency distribution, percentages, means, and standard deviations. Additionally, the acceptance level and implementation effectiveness of Objective Structured Clinical Examination (OSCE) among clinical instructors at the medical center were examined. Independent samples t-tests and one-way analysis of variance (ANOVA) were employed to explore the differences in acceptance level and implementation effectiveness of OSCE among clinical instructors with different backgrounds. In cases where one-way ANOVA yielded significant results, the Scheffé method was utilized for post hoc comparisons to understand the differences between groups for that particular variable. Pearson's correlation coefficient was employed to analyze the relationship between clinical instructors' acceptance level and implementation effectiveness of OSCE across various dimensions. The statistical significance level for all tests in this study was set at $\alpha = 0.05$.

Results

Analysis of clinical instructors' personal background variables

This study focused on clinical instructors from a certain medical center who were certified as examiners. The

survey was conducted using a stratified random sampling method. A total of 350 research questionnaires were distributed, and 287 valid questionnaires were collected (82.0%). The background variables in this questionnaire included gender, age, education level, job category, teaching experience, teacher rank, Examiner for medical/nurse exams (past 3 years), Participation in assessment sessions (past 3 years), OSCE instructor training (past 3 years). Descriptive statistical methods such as frequency distribution and percentages were used to present the basic data of the questionnaire samples, aiming to understand the distribution of basic information. Based on the Central Limit Theorem sample size guidelines, each group should have at least 30 samples to ensure that the distribution of means tends toward a normal distribution, and the larger the sample size, the closer it approaches a normal distribution with smaller variability. Therefore, in cases where the group size did not reach 30 participants, those groups were combined.

Among the respondents, 71.4% were female and 28.6% male. Age distribution showed 33.4% were 40 years or younger, 44.9% were 41–50 years, and 21.6% were above 50. Educational attainment included 54.0% with a college/university degree and 46.0% with a graduate degree. Regarding job categories, 65.5% worked in institutions with over 101 medical professionals, 13.2% in facilities with 51–100, and 21.3% in smaller institutions with 50 or fewer personnel. Teaching experience varied, with 15.3% having ≤ 5 years, 17.8% with 6–10 years, 20.9% with 11–25 years, and 46.0% with over 26 years. Faculty ranks included 41.1% ordinary faculty, 32.8% advanced faculty, and 26.1% senior faculty. Professional assessment participation in the past three years showed 20.2% served as medical/nursing examiners. Additionally, 30.3% attended ≥ 3 assessment sessions, 27.9% attended 1–2, and 41.8% had no participation. OSCE instructor training was completed by 66.9%, while 33.1% had no training.

Clinical instructors' level of agreement and implementation effectiveness of OSCE

To understand the current status of clinical instructors' level of agreement and implementation effectiveness regarding the OSCE at a certain medical center, statistical methods such as mean and standard deviation were employed to analyze participants' responses in various dimensions and the overall scale of the questionnaire. This study utilized a Likert-type five-point scale for differentiation, with average scores ranging from 0 to 5 for each dimension. An average score above 4.50 indicates "strongly agree," while a score between 3.50 and 4.49 indicates "agree." A score between 2.50 and 3.49 represents "neutral," whereas a score between 1.50 and 2.49 denotes "disagree." An average score below 1.50 signifies "strongly disagree."

The average scores of the level of agreement in various dimensions of the acceptance scale are ranked as follows: "Teaching Professional Growth" (M = 4.35), "Teaching Resources and Administrative Efficiency" (M = 4.33), "Teaching Curriculum Policies" (M = 4.26), and " Student Learning Achievements" (M = 4.23). From the average scores, it can be inferred that clinical instructors' level of agreement regarding the OSCE tends to be in the "Agree" range for dimensions such as "Teaching Resources and Administrative Efficiency," "Teaching Professional Growth," "Teaching Curriculum Policies," and " Student Learning Achievements."

In the analysis of questionnaire items, the highest average scores were observed in statements such as No. 9 (M = 4.38), No. 7 (M = 4.37), No. 2 and No. 3 (M = 4.36). The lowest average scores were observed in statements such as No. 20 (M = 4.18), No. 21 (M = 4.12), and No. 16 (M = 4.06). These three statements had relatively lower levels of agreement, as shown in Table 1.

The average scores of the different dimensions in the implementation effectiveness scale are ranked as follows: "Teaching Expertise" (M = 4.32), "Professional Attitude" (M = 4.20), and "Student Performance" (M = 4.19). From the above average scores, it can be seen that clinical instructors' performance in the implementation effectiveness of the objective structured clinical examination (OSCE) tends to be "Agree" in dimensions such as "Student Performance," "Teaching Expertise," and "Professional Attitude".

In the analysis of questionnaire items, the highest average scores are found in statements such as No. 29 (M = 4.35), No. 31 (M = 4.34), and No. 32 (M = 4.32). The lowest average scores are observed in statements like No. 24 (M = 4.17), No. 26 (M = 4.13), and No. 37 (M = 4.12), as shown in Table 2.

Analysis of clinical instructors' agreement levels of OSCE across different background variables

The analysis revealed significant differences in agreement levels based on instructors' prior experience as national examination assessors, participation in assessment sessions, and engagement in OSCE-related faculty training. Instructors with national examination assessor experience demonstrated significantly higher agreement levels compared to those without such experience ($t = 2.018$, $p = 0.045$), as presented in Table 3.

Furthermore, the frequency of assessment participation had a notable impact on agreement levels ($F = 12.270$, $p < 0.001$). Post hoc comparisons indicated that instructors who had conducted three or more assessment sessions exhibited significantly higher agreement levels than those with no assessment experience ($p < 0.001$) or with only one to two sessions ($p < 0.001$), as shown in Table 4.

Table 1 Analysis of agreement levels in various dimensions

Dimension	No.	Questionnaire Items	M	SD	Sort	Dimension Sort
Teaching Resources Administrative Efficiency	1	I believe that the hospital's training facilities and environment are well-planned and meet the needs of both teachers and students.	4.32	0.63	14	5
	2	The hospital's existing OSCE training facilities and resources allow me to demonstrate professional leadership and effectively engage in educational administration and clinical medical education training.	4.36	0.64	3	1
	3	The hospital's educational administrative team is well-organized and responsibilities are well-defined. I believe this team can effectively and accurately assist in the execution of OSCE.	4.36	0.62	3	1
	4	I think that the hospital's educational administrative team can provide teaching support to teachers and create a culture of organizational learning.	4.34	0.64	7	3
	5	The hospital can integrate internal and external resources related to OSCE, aiding in both teaching and administrative operations to enhance my satisfaction with learning.	4.28	0.68	16	6
	6	I believe that the hospital can facilitate interdisciplinary collaboration and coordination, enhancing teaching quality and teacher professional growth.	4.34	0.62	7	3
Teaching Professional Growth	7	Participating in internal and external OSCE-related training activities can enhance my professional growth.	4.37	0.59	2	2
	8	I think that investing time and effort in exploring the application of OSCE teaching can help students apply theoretical knowledge to clinical practice and enhance professional skills.	4.33	0.57	12	5
	9	I believe that regular review and improvement of OSCE teaching content can enhance teaching effectiveness and quality.	4.38	0.56	1	1
	10	Completing the development and establishment of OSCE teaching plans can implement knowledge management and professional skill growth among teachers.	4.33	0.60	12	5
	11	Integrating OSCE assessment methods across various learning domains is helpful in designing diverse teaching plans.	4.35	0.58	5	3
	12	Using the OSCE assessment method helps check students' learning outcomes.	4.34	0.57	7	4
Teaching Curriculum Policies	13	Within the current clinical assessment methods, I find OSCE training meaningful and valuable.	4.35	0.58	5	1
	14	I can combine clinical professional skills to create OSCE training plans tailored to specific professions.	4.25	0.59	18	4
	15	I believe that the OSCE training plan developed for my profession aligns with the core competency training goals of the students.	4.29	0.57	15	3
	16	I can periodically review the implementation of OSCE, assessing the extent to which training goals are achieved.	4.06	0.72	23	5
	17	I think that OSCE training has a positive impact on both teachers and students.	4.34	0.54	7	2
Student Learning Achievement	18	Through OSCE training, I believe students can understand the professional skills and deepen their learning value.	4.34	0.58	7	1
	19	After OSCE training, I think students' learning interest can be stimulated, enhancing their learning motivation.	4.24	0.63	19	3
	20	Through OSCE training, students can develop independence, problem-solving skills, and critical thinking.	4.18	0.66	21	5
	21	After OSCE training, I believe students can cultivate self-directed learning abilities.	4.12	0.72	22	6
	22	Through OSCE training, students' abilities in reflection, expression, and sharing can be enhanced.	4.23	0.66	20	4
	23	I believe that establishing diverse OSCE training plans can offer students various aspects of learning outcomes.	4.28	0.62	16	2

Additionally, faculty training in the past three years was associated with significantly higher agreement levels ($t = 3.247$, $p = 0.001$), underscoring the importance of continuous professional development in fostering positive perceptions of OSCE (Table 5).

Conversely, no significant differences in agreement levels were observed across gender, age, educational background, job category, teaching experience, or faculty rank ($p > 0.05$). These findings suggest that demographic and professional background factors do not substantially influence instructors' agreement levels regarding OSCE.

Analysis of clinical instructors' implementation efficacy of OSCE across different background variables

The findings indicate that clinical instructors' implementation efficacy of OSCE was significantly influenced by their level of participation in assessment sessions and faculty training. Instructors who had conducted three or more assessment sessions demonstrated significantly higher implementation efficacy compared to those with no assessment experience ($F = 5.900$, $p = 0.003$). Post hoc comparisons confirmed that instructors with extensive assessment experience exhibited notably stronger

Table 2 Analysis of implementation efficacy in various dimensions

Dimension	No.	Questionnaire Items	M	SD	Sort	Dimension Sort
Student Performance	24	Participating in OSCE helps me effectively enhance students' learning interests.	4.17	0.67	12	3
	25	Participating in OSCE training contributes to improving students' communication abilities.	4.22	0.66	9	2
	26	After participating in OSCE training, students' learning attitudes become more focused.	4.13	0.71	13	4
	27	Engaging in OSCE training can enhance students' learning effectiveness.	4.25	0.61	6	1
Teaching Professionalism	28	Participating in OSCE training contributes to improving my teaching quality.	4.32	0.62	3	3
	29	Engaging in OSCE training allows me to better grasp the direction of course planning and instructional material design.	4.35	0.58	1	1
	30	Participating in OSCE training helps improve my teaching skills.	4.29	0.58	5	5
	31	Participating in OSCE training enhances my feedback skills with students.	4.34	0.55	2	2
	32	Engaging in OSCE training helps me understand my strengths and weaknesses in teaching and enhances teaching abilities.	4.32	0.59	3	3
Professional Dedication	33	The process of participating in OSCE makes me willing to share teaching experiences with peers.	4.24	0.61	7	1
	34	The process of participating in OSCE enhances professional dialogues with peers.	4.21	0.63	10	3
	35	The process of participating in OSCE enhances willingness to collaborate professionally with peers.	4.24	0.63	7	1
	36	Participating in the OSCE process encourages me to actively engage in various professional teacher training activities.	4.20	0.71	11	4
	37	Participating in the OSCE process motivates me to invest more time in teaching.	4.12	0.74	14	5

Table 3 Summary of t-test analysis on clinical instructors' agreement levels across different experience as medical/nurse exam examiners (past 3 years)

Dimensions	Medical/Nurse Exam Examiners	*N*	M	SD	t-value	*p*-value
Teaching Resources Administrative Efficiency	Yes	58	4.45	0.57	1.777	0.077
	No	229	4.30	0.54		
Teaching Professional Growth	Yes	58	4.45	0.49	1.749	0.081
	No	229	4.32	0.52		
Teaching Curriculum Policies	Yes	58	4.41	0.48	2.594*	0.010
	No	229	4.22	0.51		
Student Learning Achievement	Yes	58	4.31	0.56	1.189	0.236
	No	229	4.21	0.57		
Overall	Yes	58	4.40	0.46	2.018*	0.045
	No	229	4.27	0.47		

* $p < 0.05$

implementation effectiveness ($p < 0.01$) than those with limited or no experience (Table 6).

Similarly, faculty training in the past three years was positively correlated with implementation efficacy ($t = 2.225$, $p = 0.027$). Instructors who had undergone training reported significantly greater effectiveness in applying OSCE methodologies in clinical education (Table 7).

In contrast, no significant differences in implementation efficacy were observed based on gender, age, educational background, job category, teaching experience, faculty rank, or experience as national examination assessors ($p > 0.05$). These results suggest that while structured training and assessment participation enhance OSCE implementation efficacy, general demographic and professional factors do not exert a notable influence.

Analysis of correlation between agreement and implementation effectiveness of OSCE

To investigate the correlation between the agreement levels and implementation effectiveness of clinical instructors at a medical center, Pearson's product-moment correlation coefficient was employed to analyze whether there is a significant correlation between the agreement levels and implementation effectiveness of clinical instructors. A positive correlation coefficient indicates a positive relationship between the two variables, while a negative correlation coefficient indicates a negative relationship. The magnitude of the correlation coefficient reflects the degree of association between the variables. In this study, the absolute values of the correlation coefficients were used, and when the absolute value of the correlation coefficient (denoted as γ) is less than 0.4, it indicates a "low correlation." If γ is between (inclusive)

Table 4 Summary of mean, standard deviation, and variance analysis on clinical instructors' agreement levels across different participation in assessment sessions (past 3 years)

Dimensions	Assessment sessions	N	M	SD	Analysis of Variance						post hoc comparison
					Variation	SS	*df*	MS	F	*p*	
Teaching Resources Administrative Efficiency	0 sessions	120	4.15	0.59	Between	7.837	2	3.918	13.214***	0.000	(1),(2)
	1 to 2 assessment sessions	80	4.41	0.52	Within	84.219	284	0.297			< (3)
	3 or more assessment sessions	87	4.52	0.50	Subtotal	92.056	286				
Teaching Professional Growth	0 sessions	120	4.23	0.51	Between	4.822	2	2.411	9.695***	0.000	(1),(2)
	1 to 2 assessment sessions	80	4.33	0.52	Within	70.635	284	0.249			< (3)
	3 or more assessment sessions	87	4.53	0.46	Subtotal	75.457	286				
Teaching Curriculum Policies	0 sessions	120	4.13	0.50	Between	5.701	2	2.851	11.863***	0.000	(1),(2)
	1 to 2 assessment sessions	80	4.22	0.49	Within	68.242	284	0.240			< (3)
	3 or more assessment sessions	87	4.46	0.48	Subtotal	73.943	286				
Student Learning Achievement	0 sessions	120	4.13	0.53	Between	3.574	2	1.787	5.710**	0.004	(1),(2)
	1 to 2 assessment sessions	80	4.20	0.59	Within	88.872	284	0.313			< (3)
	3 or more assessment sessions	87	4.39	0.57	Subtotal	92.446	286				
Overall	0 sessions	120	4.16	0.45	Between	5.157	2	2.578	12.270***	0.000	(1),(2)
	1 to 2 assessment sessions	80	4.29	0.47	Within	59.681	284	0.210			< (3)
	3 or more assessment sessions	87	4.48	0.45	Subtotal	64.838	286				

*** $p < 0.001$; ** $p < 0.01$

0.4 and 0.7, it indicates a "moderate correlation." When γ is greater than 0.7, it indicates a "high correlation [25, 26]."

The research findings demonstrate a significant correlation between the overall agreement levels and implementation effectiveness of clinical instructors, with each aspect showing a significantly high positive correlation ($p < 0.01$). The "Teaching Resources and Administrative Efficiency" aspect of clinical instructor agreement levels and implementation effectiveness also shows a significant moderate positive correlation ($p < 0.01$). The "Teacher Professional Growth" aspect of clinical instructor agreement levels and implementation effectiveness reveals a significant moderately high positive correlation ($p < 0.01$). The "Teaching Curriculum Policies" aspect of clinical instructor agreement levels and implementation effectiveness displays a significant moderately high positive correlation ($p < 0.01$). The " Student Learner Achievement" aspect of clinical instructor agreement levels and implementation effectiveness indicates a significant high positive correlation ($p < 0.01$).

Summing up the results, the absolute values of the correlation coefficients between the various aspects of agreement levels and implementation effectiveness range from 0.524 to 0.852. This indicates a moderately high positive correlation between the different dimensions of agreement levels and implementation effectiveness. It suggests that higher agreement levels among clinical instructors regarding OSCE correspond to higher implementation effectiveness, and higher implementation effectiveness in OSCE leads to better agreement levels, as shown in Table 8.

Discussion

Analysis of the clinical instructors' agreement levels and implementation effectiveness in the medical center

The results of this study indicate that among the dimensions of agreement levels towards OSCE, the aspect of "Teacher Professional Growth" holds the highest degree of agreement within the medical center. The items with the highest and second-highest mean scores are "Being able to periodically self-assess and improve the content of OSCE teaching training to enhance teaching effectiveness and quality" (M = 4.38) and "Participating in internal and external OSCE-related training activities to enhance personal professional growth" (M = 4.37). Regarding the dimensions of OSCE implementation effectiveness, the aspect of "Teaching Professionalism" demonstrates the highest level of agreement. The items with the highest and second-highest mean scores within this aspect are "Participating in OSCE training helps to better understand the direction of curriculum planning and instructional material design" (M = 4.35) and "Participating in

Table 5 Summary of t-test analysis on clinical instructors' agreement levels in relation to OSCE instructor training experience (past 3 years)

Dimensions	Training Experience	*N*	M	SD	t-value	*p*-value
Teaching Resources Administrative Efficiency	Yes	192	4.42	0.50	3.690***	0.000
	No	95	4.16	0.65		
Teaching Professional Growth	Yes	192	4.42	0.48	3.181*	0.002
	No	95	4.21	0.55		
Teaching Curriculum Policies	Yes	192	4.31	0.49	2.547*	0.011
	No	95	4.15	0.53		
Student Learning Achievement	Yes	192	4.28	0.55	1.949	0.052
	No	95	4.14	0.59		
Overall	Yes	192	4.36	0.45	3.247**	0.001

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 6 Summary of mean, standard deviation, and variance analysis on clinical instructors' implementation efficacy across different participation in assessment sessions (past 3 years)

Dimensions	Assessment sessions	N	M	SD	Analysis of Variance						post hoc comparison
					Variation	SS	*df*	MS	F	*p*	
Student Performance	0 sessions	120	4.12	0.55	Between	2.497	2	1.248	3.478*	0.032	(3)> (1),(2)
	1 to 2 assessment sessions	80	4.14	0.61	Within	101.93	284	0.359			
	3 or more assessment sessions	87	4.33	0.66	Subtotal	104.426	286				
Teaching Professionalism	0 sessions	120	4.22	0.54	Between	4.205	2	2.103	7.621***	0.001	(3)> (1),(2)
	1 to 2 assessment sessions	80	4.29	0.56	Within	78.349	284	0.276			
	3 or more assessment sessions	87	4.50	0.46	Subtotal	82.554	286				
Professional Dedication	0 sessions	120	4.14	0.58	Between	3.285	2	1.643	4.651*	0.010	(3)> (1),(2)
	1 to 2 assessment sessions	80	4.12	0.63	Within	100.314	284	0.353			
	3 or more assessment sessions	87	4.36	0.58	Subtotal	103.599	286				
Overall	0 sessions	120	4.16	0.53	Between	3.289	2	1.644	5.900**	0.003	(3)> (1),(2)
	1 to 2 assessment sessions	80	4.19	0.55	Within	79.163	284	0.279			
	3 or more assessment sessions	87	4.40	0.51	Subtotal	82.452	286				

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

Table 7 Summary of t-test analysis on clinical instructors' implementation efficacy in relation to OSCE instructor training experience (past 3 years)

Dimensions	Training Experience	*N*	M	SD	t-value	*p*-value
Student Performance	Yes	192	4.21	0.59	0.786	0.433
	No	95	4.15	0.63		
Teaching Professionalism	Yes	192	4.38	0.51	2.767**	0.006
	No	95	4.20	0.58		
Professional Dedication	Yes	192	4.26	0.56	2.467*	0.014
	No	95	4.08	0.66		
Overall	Yes	192	4.29	0.50	2.225*	0.027
	No	95	4.14	0.59		

** $p < 0.01$; * $p < 0.05$

Table 8 Correlation analysis of the agreement and implementation efficacy in OSCE

Dimensions			Implementation Efficacy			
			Student Performance	Teaching Professionalism	Professional Dedication	Overall
Agreement	**Teaching Resources Administrative Efficiency**	**Pearson correlation**	0.524**	0.592**	0.556**	0.603**
	Teaching Professional Growth	**Pearson correlation**	0.659**	0.755**	0.725**	0.772**
	Teaching Curriculum Policies	**Pearson correlation**	0.687**	0.742**	0.733**	0.779**
	Student Learning Achievement	**Pearson correlation**	0.811**	0.780**	0.788**	0.855**
	Overall	**Pearson correlation**	0.761**	0.812**	0.793**	0.852**

$N = 287$; ** $p < 0.01$

OSCE training enhances feedback skills towards students" (M = 4.34).

Differences in clinical instructors' agreement levels towards OSCE based on various background variables

The research findings indicate that clinical instructors with different genders, ages, educational backgrounds, occupational categories, teaching experience, and teaching ranks exhibit no significant differences in their agreement levels towards the OSCE on both specific aspects and the overall scale. The agreement levels of clinical instructors towards OSCE are not influenced by these background variables. Originally, this study considered that the number of instructors in different occupational categories might impact their agreement levels due to potential variations in material preparation and resource allocation for clinical activities. However, the results suggest that even with varying numbers of instructors in different categories, there are no significant differences in their agreement levels towards OSCE. On the other hand, the experience of clinical instructors in serving as national examination assessors, the number of actual assessment sessions conducted in the past three years, and whether they have received teacher training within the past three years significantly impact their agreement levels towards OSCE. This indicates that clinical instructors who have experience as examiners, have conducted more assessment sessions, and have undergone recent teacher training exhibit higher levels of agreement towards the Objective Structured Clinical Examination.

Differences in clinical instructors' implementation effectiveness of OSCE based on various background variables

The research findings reveal that clinical instructors with different genders, ages, educational backgrounds, occupational categories, teaching experience, and teaching ranks exhibit no significant differences in the implementation effectiveness of the OSCE on specific aspects as well as the overall scale. The implementation effectiveness of OSCE is not influenced by these background variables. Similar findings have been reported in previous research, which showed that examiners from diverse backgrounds can achieve good agreement in OSCE assessments when using standardized criteria, despite individual differences in scoring approaches [28].

However, the experience of clinical instructors in serving as national examination assessors does not show significant differences in the overall implementation effectiveness. Yet, it does show significant differences in the "Learner Performance" and "Teaching Professionalism" aspects of implementation effectiveness. Clinical instructors with experience as national examination assessors exhibit significantly higher implementation effectiveness compared to those without such experience, aligning with the hypothesis of this study. The number of actual assessment sessions conducted in the past three years significantly impacts the implementation effectiveness of the OSCE as a whole. Post hoc comparisons indicate that clinical instructors who conducted "3 or more assessment sessions" in the past three years have significantly higher implementation effectiveness compared to clinical instructors with "no actual assessment sessions." Whether clinical instructors received teacher training within the past three years results in a significant overall difference in the implementation effectiveness of OSCE. However, this difference is not significant in the "Learner Performance" aspect, suggesting that learner performance is not affected by whether clinical instructors have received teacher training.

Correlation between clinical instructors' agreement level and implementation effectiveness of OSCE

Significant differences in the correlation between clinical instructors' agreement level and the implementation effectiveness of OSCE are observed across various aspects. The correlation coefficients (γ values) in descending order are "Overall Implementation Effectiveness" (γ = 0.852), "Teaching Professionalism" (γ = 0.812), "Professional Attitude" (γ = 0.793), and "Learner Performance" (γ = 0.761). These correlations exhibit a significant and strong positive relationship, with all significance levels being $p < 0.01$. The absolute values of correlation coefficients between agreement levels and implementation effectiveness range from 0.524 to 0.852, indicating a moderate to high positive correlation across different dimensions. These findings indicate that higher agreement levels among clinical instructors correspond to greater OSCE implementation effectiveness. This aligns with Hawezy et al. (2024), which demonstrated that examiners with prior OSCE experience perceive it as a fair and comprehensive assessment tool, enhancing confidence in its use. Additionally, structured OSCE frameworks, such as the Grand OSCE (GOSCE), further support its acceptance and effectiveness in medical education, reinforcing the observed correlation in this study [29].

Conclusions

This study demonstrates that clinical instructors at the medical center exhibit high agreement with and effective implementation of the Objective Structured Clinical Examination (OSCE). Key findings are summarized as follows:

(1) High Agreement Levels with OSCE: Clinical instructors achieved an overall high agreement score (4.29), particularly in "Teacher Professional Growth,"

indicating a strong commitment to improving their understanding and application of OSCE despite clinical responsibilities.

(2) Effective OSCE Implementation: The overall implementation effectiveness score (4.24) underscores the positive impact of OSCE on "Teaching Expertise," reinforcing its role in enhancing instructional quality and professional development.

(3) Impact of Assessment Frequency: Instructors who participated in OSCE assessments more frequently over the past three years demonstrated significantly higher agreement levels, suggesting that hands-on experience fosters greater acceptance and integration of OSCE in teaching practices.

(4) Influence of Teacher Training: Those who received training within the past three years exhibited higher implementation effectiveness, emphasizing the value of structured training in improving instructional strategies and assessment proficiency.

(5) Positive Correlation Between Agreement and Implementation: A significant correlation (ranging from 0.524 to 0.852) between agreement levels and implementation effectiveness indicates that greater acceptance of OSCE translates into more effective application.

These findings suggest that increasing participation in OSCE assessments and structured faculty training can further enhance instructional quality. Hospital administrative education units should facilitate interdisciplinary collaborations and targeted training to optimize OSCE adoption and improve both instructor competencies and student learning outcomes.

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Data availability
Data available on request due to restrictions regarding privacy, legal and ethical concerns. The data presented in this study are available on request from the corresponding author.

Declarations

Ethics approval and consent to participate
The procedures employed in this study complied with the ethical standards of the relevant institutional and national research committees and adhered to the principles of the 1964 Declaration of Helsinki and its subsequent amendments or equivalent ethical guidelines. The study was approved by the Institutional Review Board (IRB) of Changhua Christian Hospital (CCH) under reference number 220418, with approval granted on May 4, 2022. All participants were fully informed about the study's objectives, procedures, and their rights, and written informed consent was obtained prior to participation.

Consent for publication
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Conflicts of interest
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