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Evaluation of Online Learning Models for Continuing Health Professions Education: A Case Study of the First Aid Training and Organization Methods Course for Military Health Personnel

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Abstract

Objective

To quantitatively and qualitatively compare learning outcomes of two online continuing health professions education (CHPE) models for military health personnel: self-directed learning only (Group A) and modular course selection integrated with systematic online teaching services (Group B).

Methods

This retrospective mixed-methods study collected platform data from 31,680 enrollees across 10 semesters (2020–2024). Quantitative indicators included enrollment stability, learning progress completion, examination participation rate, crude pass rate, and score distribution, analyzed via IBM SPSS Statistics 27.0 using chi-square and nonparametric tests. Thirty-four participants completed semi-structured telephone interviews until data saturation; transcripts were coded in NVivo 12.0 with inter-coder reliability Kappa = 0.86.

Results

Group B demonstrated stable enrollment without statistical outliers. The proportion of learners finishing 90%–100% of coursework (77% vs. 64%), high examination scores (81–100; 74% vs. 61%), examination participation (76% vs. 53%), and crude pass rate (73% vs. 50%) were all significantly higher in Group B ($P < 0.001$). Test-taker pass rates showed no intergroup difference (95% vs. 94%, $P > 0.05$). Qualitative themes including enrollment motivation, perceived efficient learning design, peer recommendation intention, and exam attitudes were consistent between cohorts, with uniformly high learner satisfaction.

Conclusion

The optimized modular online CHPE model effectively improves multiple learning indicators and matches the unique fragmented-time characteristics of military health personnel. Curriculum development should center on post occupational demands, modular segmentation, interactive academic support, and flexible assessments. Hybrid training frameworks and multi-dimensional learning evaluation systems deserve further exploration.

1 Introduction

Continuing health professions education (CHPE) has become a core component of national lifelong learning strategies in China over the past decade (Ministry of Education of the People's Republic of China, 2019; Zhu, 2020). Amid growing occupational competition, clinical practitioners rely on ongoing

education to advance careers, adapt to technological updates, and reduce the risk of professional elimination.

CHPE targets practicing medical workers to upgrade professional literacy, refresh clinical knowledge, and strengthen operational skills. Distinct from pre-service academic education, CHPE features strong occupational targeting, broad learner coverage, and timely content iteration (Shi & Hao, 2022; Yu, 2020). Military health personnel constitute the core of battlefield medical support; their continuous training directly shapes troop combat effectiveness, soldier physical maintenance, and emergency medical response efficiency (Jiang et al., 2021; Duan et al., 2023).

Constrained by scattered garrisons, sudden operational missions, and fragmented spare time, military medical education authorities have built dual intranet and internet CHPE platforms to support anytime-anywhere learning (Ma et al., 2025). Traditional centralized offline training cannot accommodate irregular military schedules. Military medical universities therefore developed the standardized online course First Aid Training and Organization Methods to satisfy the micro-learning demands of frontline military medical staff (Chen et al., 2023).

This mixed-methods research evaluates two iterative versions of this battlefield first-aid online curriculum, contrasting quantitative learning metrics and qualitative learner experience to provide evidence-based optimization suggestions for military CHPE construction.

2 Subjects and Methods

2.1 Curriculum Development and Two Instructional Modes

Battlefield first aid forms the primary tier of military stratified casualty care, critical for reducing wound mortality, improving long-term prognosis, sustaining troop morale, and maximizing combat capacity. The curriculum focuses on self-rescue, buddy rescue, and standardized training management protocols. Six core practical skills are demonstrated across four combat scenarios: airway management, hemostasis, bandaging, fracture fixation, casualty transport, and basic life support, covering nearly 100 independent operational techniques. Multimedia materials including images, audio, and 3D virtual simulation videos visualize complex operations to boost learner engagement.

The course was delivered across 10 semesters (2020–2024) with identical first-aid content and final assessments, divided into two independent teaching groups:

1. Group A (Semesters 1–5): Self-directed learning only

The initial version merely provided basic lecture videos and static test banks without real-time instructor interaction, supplementary reading materials, or offline practical training guidance. Single-resource formats frequently caused discontinuous learning and low sustained engagement.

2. Group B (Semesters 6–10): Modular course selection + integrated online teaching services

Three systematic optimizations were implemented based on Group A's framework:

Resource expansion: Multi-casualty collaborative rescue simulation footage, 5–10 minute micro-modules targeting single knowledge points, and electronic textbooks & reference literatures;

Service upgrade: Scheduled online Q&A (1 academic hour daily during semesters, 2 academic hours weekly in off-semester periods) and dynamic case-driven test bank updates;

Practical supplementation: Optional centralized offline hands-on training and on-site assessment for military units to resolve the disconnect between online theoretical learning and field practice.

Table 1 displays structural differences between the two curriculum versions.

Table 1
Structural Comparison of Two Online First-Aid Curriculum Iterations

Group	Semesters Delivered	Instructional Model	Total Lecture Videos	Total Video Runtime (Minutes)	Number of Test Items
A	1–5	Self-directed only	28	263.7	141
B	6–10	Modular + online teaching services	32	304.3	161

2.2 Quantitative Study Population

All learners who enrolled in the course from January 2020 to December 2024 were screened. Participants with incomplete learning progress records or missing examination scores were excluded. The final analytical sample included 31,680 enrollees (Group A = 21,269; Group B = 10,411).

2.3 Qualitative Semi-Structured Interviews

2.3.1 Sampling Strategy

Purposive sampling was adopted, with recruitment terminated upon data saturation—defined as no new thematic codes emerging from consecutive interview transcripts (Peng & Wang, 2025).

2.3.2 Eligibility Criteria

1. Completed full online course learning;
2. Possess clear verbal expression ability to describe learning experiences;
3. Voluntarily provide written informed consent for audio recording and data analysis.

2.3.3 Baseline Characteristics of Interviewees

Interviews were conducted from May to June 2025, recruiting 18 learners from Group A and 16 from Group B. Baseline demographic indicators (gender, age bracket, education background, course learning duration) showed no statistically significant intergroup differences (all P > 0.05), ensuring sample comparability (see Table 5).

2.3.4 Interview Guide Development

Four core dimensions framed the interview protocol: enrollment motivation, perceived efficient curriculum design, peer recommendation willingness, and examination perception. Five non-sample participants completed pilot interviews to revise ambiguous wording before formal data collection. The final core interview questions were:

1. What are your primary reasons for registering in this battlefield first-aid course?
2. Which curriculum designs help you study efficiently amid busy military work schedules?
3. Would you recommend this course to military medical colleagues? Explain your reasoning.
4. Did you complete the final examination after learning? If yes, evaluate exam difficulty and its alignment with course content; if no, state the main barriers.

2.3.5 Data Collection and Analytical Procedures

All interviews were conducted via telephone with a controlled duration of approximately 30 minutes. Audio recordings were transcribed verbatim within 48 hours after each interview. NVivo 12.0 software was used for qualitative content analysis. Two independent researchers coded all transcripts separately; inter-coder reliability reached Kappa = 0.86, representing excellent consistency. Discrepancies were resolved through group discussion and repeated data verification.

2.3.6 Quality Control

All research members received standardized training on qualitative interview methodology. Leading or suggestive questions were strictly avoided to maintain neutrality. Triangulation between quantitative platform data and qualitative interview themes enhanced result credibility.

2.4 Quantitative Statistical Analysis

All statistical analyses were performed using IBM SPSS Statistics 27.0 software. Categorical data were presented as counts and percentages and compared via Pearson chi-square tests. Continuous enrollment fluctuation indicators (median, interquartile range, standard deviation) were assessed using nonparametric rank-sum tests. A two-sided P value less than 0.05 was defined as the threshold for statistical significance.

3 Results

3.1 Overall Course Enrollment Trends

Across 10 semesters, total course enrollment reached 31,680 learners. Average semesterly enrollment was higher in Group A (M = 708.97) than Group B (M = 347.03). Higher initial registration volume in Group A reflected concentrated pent-up demand for standardized battlefield first-aid training. As course coverage expanded, the number of untrained personnel with training requirements gradually decreased, leading to lower enrollment in Group B's later semesters (Table 2).

Table 2
Semesterly Enrollment Metrics by Curriculum Group

Group	Delivery Window	Total Enrollees	Mean Enrollees per Semester	Standard Deviation of Semester Enrollment
A	Jan 2020–Jun 2022	21,269	708.97	590.54
B	Jul 2022–Dec 2024	10,411	347.03	190.23

3.2 Intergroup Comparison of Quantitative Learning Indicators

3.2.1 Enrollment Stability

Group A exhibited severe semesterly enrollment volatility (SD = 590.54), with 12 outlier semesters and an enrollment range of 2,568 (max = 2,758; min = 190). Median enrollment for Group A was 520 (interquartile range, IQR = 565). Group B's registration numbers clustered tightly without statistical outliers (SD = 190.23, range = 760; median = 322, IQR = 218). Enrollment fluctuations in Group A were easily disturbed by temporary military missions, while Group B's optimized design significantly improved sustained participation stability.

3.2.2 Learning Progress Completion

The proportion of learners finishing 90%–100% of all modules was significantly higher in Group B (77%) compared with Group A (64%). The share of learners stagnating at 0%–10% progress was slightly elevated in Group A (18% vs. 16%), indicating weaker continuous learning motivation under the basic video-only mode. Intergroup progress distribution differences were statistically significant ($\chi^2 = 18.62$, $P < 0.01$).

3.2.3 Final Examination Score Distribution

Group A contained larger proportions of low and medium score segments (0–60 = 6%; 61–80 = 33%), while Group B's high-score segment (81–100) reached 74% versus Group A's 61%. Global chi-square test confirmed significant intergroup score differences ($\chi^2 = 12.35$, $P < 0.001$; Table 3).

Table 3
Distribution of Final Examination Scores (%)

Score Band	Group A (%)	Group B (%)
0–60	6	2
61–80	33	23
81–100	61	74
Note. Global $\chi^2 = 12.35$, $P < 0.001$ for cross-group comparison of score distribution.		

3.2.4 Examination Participation and Pass Rate Indicators

Although Group A possessed a larger total enrollment base, its examination participation rate and crude overall pass rate were substantially lower than Group B. Test-taker pass rates were nearly identical between the two cohorts with no statistical difference (94% vs. 95%, $P > 0.05$; Table 4).

Table 4
Examination Participation and Pass Rate Indicators

Group	Total Enrollees	Test Takers	Learners Who Passed	Participation Rate (%)	Crude Pass Rate (%)	Test-Taker Pass Rate (%)
A	21,269	11,327	10,641	53	50	94
B	10,411	7,959	7,569	76	73	95
Note. Crude pass rate = number of passed learners / total enrollees × 100%; test-taker pass rate = number of passed learners / total examination participants × 100%. Intergroup differences in participation and crude pass rate: $P < 0.001$; test-taker pass rate comparison: $P > 0.05$.						

3.3 Qualitative Interview Results

Baseline demographic balance of interview participants is presented in Table 5. Four core thematic domains showed consistent learner perceptions without meaningful intergroup gaps, and overall course satisfaction remained high across both groups.

Table 5
Baseline Demographic Characteristics of Interview Participants

Characteristic	Subcategory	Group A (n = 18) n (%)	Group B (n = 16) n (%)	χ^2	P
Gender	**Male**	**8 (44.4)**	**7 (43.8)**	**0.08**	**0.78**
	Female	**10 (55.6)**	**9 (56.2)**		
Age (Years)	**25–30**	**6 (33.3)**	**5 (31.2)**	**0.15**	**0.93**
	31–40	**8 (44.4)**	**7 (43.8)**		
	41–45	**4 (22.2)**	**4 (25.0)**		
Education	**Bachelor's degree or above**	**15 (83.3)**	**14 (87.5)**	**0.09**	**0.77**
	College or below	**3 (16.7)**	**2 (12.5)**		
Learning Duration (Months)	**1–2**	**10 (55.6)**	**9 (56.2)**	**0.21**	**0.90**
	2–3	**8 (44.4)**	**7 (43.8)**		
Note. All P values > 0.05, no significant intergroup demographic differences.					

Theme 1: Homogeneous Enrollment Motivations

Over 40% of interviewees selected the course to satisfy mandatory occupational skill upgrade requirements. Approximately 30% enrolled due to positive platform reputation and peer recommendations; around 20% valued flexible self-paced micro-learning to fit fragmented spare time. No participants cited curriculum model differences as a primary enrollment driver.

Theme 2: Shared Recognition of Modular Design with Divergent Service Demands

All learners acknowledged modular segmentation as suitable for fragmented military learning. Group A participants requested expanded clinical case videos, real-time instructor Q&A channels, and supplementary reference materials. Group B respondents positively evaluated progressive module logic, on-demand tutoring, and embedded electronic literatures.

Theme 3: Comparable Peer Recommendation Intent

Willingness to recommend the course reached 82% (Group A) and 80% (Group B). Participants unwilling to share the course only cited mismatched personal learning demands rather than poor curriculum quality.

Theme 4: Identical Barriers to Examination Completion

Roughly 55% of interviewees completed examinations to verify learning gains and obtain official training certificates; 45% skipped testing mainly due to conflicting military operational schedules (70%) or lack of certification requirements (30%).

4 Discussion

4.1 Impacts of Optimized Modular Online CHPE on Learning Outcomes

This mixed-methods evaluation confirmed that the modular curriculum with integrated teaching services significantly improved enrollment stability, learning completion, exam participation, and academic performance relative to passive self-directed learning, consistent with existing online health education research (Li et al., 2022). Military health staff's unique occupational constraints including irregular deployments, sudden task surges, and discontinuous spare time limit the effectiveness of video-only training. Group A's lack of interactive support and offline skill consolidation led to volatile registration, weak sustained engagement, and lower exam scores.

Three targeted optimizations resolved core learning barriers: micro-modular segmentation adapted to fragmented schedules and stabilized enrollment trends; scheduled live tutoring and dynamic case test banks formed a closed-loop "learn–query–practice" system, raising exam participation by over 20 percentage points; supplementary offline practical training bridged theory-practice gaps, increasing the proportion of high-score learners and supporting occupational competency development (Chen, 2024; Jia et al., 2025).

4.2 Learner Satisfaction and Curricular Optimization Implications

Uniform high satisfaction across both curriculum versions indicates that the core battlefield first-aid content fully meets military training requirements, while quantitative gaps stem from insufficient auxiliary services rather than defective content. Occupation-driven enrollment motivations confirm that military CHPE curricula must center on real post work demands to maintain learner participation. All learners recognized modular segmentation as foundational for micro-learning; real-time instructor interaction, supplementary resources, and offline hands-on training are indispensable complementary components.

Time conflict from military missions was the dominant barrier to exam completion. Future online CHPE should adopt flexible phased and hybrid online-offline assessment modes to reduce schedule friction and lift examination participation rates.

4.3 Study Limitations and Future Research Directions

Three key limitations restrict the generalizability of findings: first, the sample only includes enrollees of a single battlefield first-aid course without cross-curriculum verification; second, this study relies solely on platform examination scores and interview feedback without standardized offline practical skill quantitative evaluation; third, no long-term follow-up was conducted to track the workplace application of learned first-aid skills.

Subsequent military CHPE research can expand sampling across diverse medical training courses, integrate standardized hands-on skill assessments, and implement multi-year workplace competency tracking. Technological development directions include mixed reality immersive simulation modules and AI automatic tutoring systems to expand asynchronous learning support (Xu et al., 2025; Wang et al., 2024). A multi-dimensional learning outcome evaluation framework combining platform behavior data, examination results, practical performance, and field application effects requires further construction (Shao et al., 2025; Zhou & Yang, 2024). Additionally, online-offline hybrid (OMO) training models should be refined to combine self-paced online theoretical learning with centralized offline skill drills, balancing learning flexibility and practical proficiency for military health personnel (Zhang et al., 2025).

Declarations

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Ethics statement

All subjects gave their informed consent for inclusion before they participated in the study. The study was conducted in accordance with the Declaration of Helsinki, and the protocol was approved by the Ethics Committee of the Second Affiliated Hospital of the Air Force Medical University of the Chinese People's Liberation Army (K202509-68) .

Conflict of Interest Statement

The authors declare no competing financial or non-financial interests.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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