

EVALUATING AN INNOVATIVE CO-CREATION MODEL FOR TEACHING AND LEARNING IN COMMUNITY MEDICINE

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Abstract

Background: As preventive medicine gains importance, healthcare professionals must be equipped with competencies in community health promotion and engagement. To strengthen these skills, a student co-creation model was introduced in the “Introduction to Community Medicine” course at Phramongkutklao College of Medicine, Thailand. Third-year medical students were divided into ten groups and tasked with designing and delivering peer-teaching sessions on public health topics, positioning them as both learners and educators. Despite its growing recognition, co-creation in community medicine remains underexplored, particularly in settings where students assume dual roles as teachers and learners.

Objectives: This study evaluated students’ perceptions of the co-creation model and its performance in examinations compared with traditional lecture-based learning in community-oriented medical education.

Methods: This descriptive study compared examination outcomes between the 2022 lecture-based cohort and the 2023 co-creation cohort. Examination data were analyzed using descriptive statistics and measures of variability. Student perceptions were collected through an anonymous survey comprising five-point Likert-scale items, open-ended questions, and a multiple-choice recommendation item, yielding an 80% response rate (N = 95).

Results: Students reported positive perceptions of the co-creation experience, describing it as engaging and meaningful for learning through teaching. Reported learning related experiences included communication skills, teamwork, creativity, and confidence in explaining public health concepts. Challenges like time constraints and uneven workload distribution among group members are also reported. A majority of respondents indicated that they would recommend continuing the co-creation approach. Examination scores differed between the 2022 and 2023 cohorts, with mean scores of 41.0% and 56.2%, respectively. Score variability, expressed as the coefficient of variation, was 21.6% in 2022 and 17.5% in 2023. These results are presented descriptively, and no causal inferences can be drawn from this comparison.

Conclusion: Student co-creation was associated with positive learning experiences and high levels of student engagement in community medicine education. Examination results provide contextual information on knowledge acquisition but may not fully reflect collaborative and creative competencies emphasized in the co-creation process. These findings suggest that student co-creation is a feasible pedagogical approach in community-oriented medical education, while highlighting the need for future research that uses aligned assessment strategies and more robust study designs.

Keywords: student co-creation; community medicine; medical education; active learning; learner engagement

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Introduction

Student co-creation in medical education has grown as a response to the limitations of traditional lecture-based teaching, which often fails to meet the dynamic needs of today's students.⁽¹⁾ Evidence indicates that medical students seek recognition as partners in their education, contributing to curriculum design and decision-making processes rather than serving solely as passive recipients of knowledge or as providers of feedback.^(2,3) Learners also value safe and supportive environments that foster belonging, open dialogue, and constructive relationships with teachers.⁽⁴⁾

Co-creation is defined as a collaborative process in which learners' perspectives are actively incorporated into the design, delivery, and evaluation of education.⁽⁵⁾ Through partnership, students shift from passive participation to active engagement, strengthening both teaching quality and educational outcomes. Such collaboration supports inclusive, relevant learning experiences aligned with students' lived realities and professional development needs.⁽⁶⁾

Despite growing recognition of student partnership models, community medicine teaching in Thailand remains predominantly lecture-driven, offering limited opportunities for learners to actively design, lead, and reflect on health promotion education; this constrains student agency, contextual application, and ownership of learning, particularly in population-based topics requiring adaptability, social awareness, and community engagement.⁽⁷⁾ In military medical education, the traditionally hierarchical structure further reinforces passive learning, limiting op-

portunities for learner agency and pedagogical autonomy, which creates a critical need for innovative approaches that empower students as active contributors rather than knowledge recipients.

Community medicine is vital for addressing population health and health inequities, but faces challenges posed by diverse populations, complex care needs, and persistent disparities.⁽⁸⁾ While patient-centered care is fundamental, it is insufficient on its own; community medicine must also adopt socially accountable, community-engaged frameworks to address broader determinants of health.⁽⁹⁾ Preparing future physicians, therefore, requires educational strategies that build competencies in health literacy, interprofessional collaboration, and effective communication.⁽¹⁰⁾

An illustrative example is the University of Adelaide's student-community partnership model, where oral health students co-created health promotion programs with local organizations.⁽¹¹⁾ Through relationship-building and immersive learning, students enhanced cultural competence and fostered trust with socially excluded populations. These initiatives demonstrate how co-creation can strengthen practical, community-oriented learning and reflect the AMEE Guide's emphasis on enhanced motivation, psychosocial development, and learner-teacher relationships.⁽¹²⁾

Despite growing calls for participatory learning, community medicine education in Thailand has largely remained teacher-driven, with limited structured mechanisms for students to actively shape curricular content or assume instructional responsibility. In community medicine, where

responsiveness and authentic engagement are essential, co-creation offers a transformative approach to aligning education with the needs of both students and communities. This study implemented a structured student co-creation model in the Introduction to Community Medicine course and evaluated its effectiveness compared with traditional lecture-based instruction.

Methods

Study design and setting

This descriptive study analyzed secondary educational data from the Department of Military and Community Medicine, Phramongkutklo College of Medicine (PCMMC). Examination outcomes from lecture-based instruction in 2022 were compared with those from a student co-creation model implemented in 2023 in the Introduction to Community Medicine (PCMMC 301) course. The co-creation project aimed to enable students to collaboratively analyze public health problems, apply health promotion principles, and develop prevention strategies across all levels of prevention: primordial, primary, secondary, tertiary, and quaternary.

The primary objective of this study was to evaluate students' perceptions and learning experiences regarding the student co-creation model, using post-course survey data. A secondary, exploratory objective was to descriptively compare examination performance between the

2022 lecture-based cohort and the 2023 co-creation cohort to examine potential differences in learning outcomes.

Participants

Ninety-five third-year medical students participated in the PCMMC 301 course of the 2023 academic year. For survey analysis, the minimum sample size ($n = 76$) was calculated using Taro Yamane's formula with a 95% confidence level and a 5% margin of error.⁽¹³⁾ Students who did not complete the survey were excluded from the analysis. An independent-samples Welch's t-test was conducted to compare mean examination scores between the 2022 lecture-based cohort and the 2023 student co-creation cohort. Because the cohorts comprised different student populations and examination content was not identical across academic years, this analysis was considered exploratory and descriptive rather than inferential. Liu et al. conducted a comparative study in an evidence-based medicine course, comparing post-test scores and pre-to-post score changes between blended-learning and traditional-lecture groups, using t-tests to assess differences in learning outcomes.⁽¹⁴⁾ Similarly, exploratory t-tests have been used in educational research to descriptively compare examination performance between instructional approaches, even when student cohorts and assessment contexts differ. **Figure 1** presents the flow of participants included in the study.

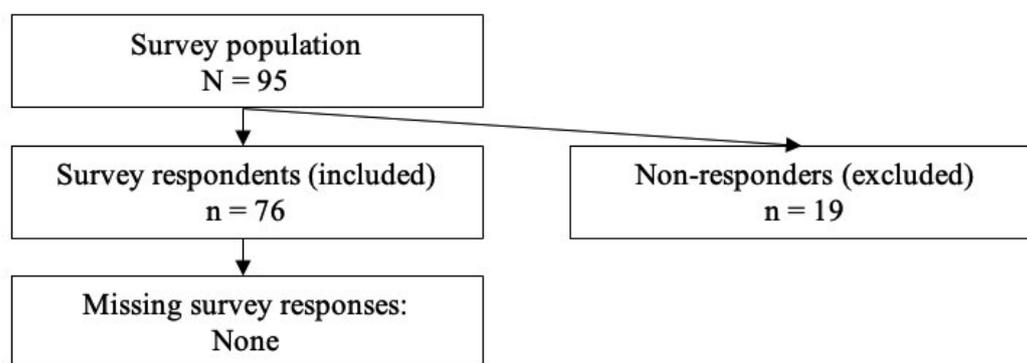


Figure 1. Flow diagram of student participation in the co-creation survey. Of the total survey population ($N = 95$), 76 respondents (80%) completed the questionnaire and were included in the analysis. Nineteen students (20%) did not respond and were excluded. No missing data was reported among the included participants.

Implementation of the student co-creation model

The 2023 Introduction to Community Medicine course was implemented using a structured student co-creation model in which learners assumed active roles as co-educators. Students were organized into ten groups and assigned community health topics spanning life-course, occupational, psychosocial, and health system domains. Each group was responsible for researching content, designing peer-teaching activities, facilitating classroom learning, and generating examination questions under faculty guidance.

In contrast, the 2022 course was delivered through faculty-led symposia organized around major life-course stages, including child, adolescent, adult, and elderly health. Despite differences in instructional structure, both cohorts addressed comparable core content in community health promotion and disease prevention. This alignment ensured curricular continuity while allowing greater flexibility, contextualization, and student ownership of learning in the co-creation cohort.

Co-creation process

This intervention was implemented within a military medical education context characterized by structured hierarchy, high academic discipline, and limited prior experience with student-led pedagogy. Introducing co-creation within this setting was therefore both pedagogically innovative and culturally transformative. Students were divided into ten groups, each assigned a public health topic: (1) Child Health and Development, (2) Adolescent Health, (3) School Health, (4) Elderly Health, (5) Working-Age Population Health, (6) Musculoskeletal Burden, (7) Maternal Health, (8) Oral Health and Preventive Dentistry, (9) Community Pharmacy, and (10) Community Psychology and Society. The intervention design was informed by principles of student partnership and self-determination theory, emphasizing autonomy, competence, and relatedness as drivers of deep learning. Co-creation was operationalized as a shared epistemic process in which learners contributed meaningfully to curriculum structure, knowledge construction, and assessment design.

The process followed a structured nine-step sequence: (1) topic introduction and relevance, (2) brainstorming and task allocation, (3) research and content development, (4) formulation of 10 exam questions per group, (5) rehearsal and refinement with peer-and-faculty feedback, (6) inter-group peer practice sessions, (7) preparation of final materials, (8) formal classroom presentation, and (9) reflection and discussion with faculty input. At the end of the project, students sat for an examination composed of instructor-modified items derived from student-generated questions and completed an evaluation form about their experiences. Throughout the process, faculty intentionally minimized direct instruction, allowing students to navigate uncertainty, negotiate group roles, and experiment with teaching strategies, creating a safe space for productive struggle and reflective learning. This deliberate withdrawal of faculty control enabled authentic learner decision-making, revealing both the opportunities and the tensions inherent in collaborative educational design.

Student learning was assessed using multiple complementary approaches. Summative assessment consisted of a multiple-choice question (MCQ) examination designed to evaluate knowledge acquisition in community medicine and health promotion. Formative assessment occurred throughout the co-creation process and included faculty observation of students' teaching and facilitation skills, peer feedback during rehearsal and practice sessions, reflective discussions following classroom presentations, and post-course student surveys. Although these formative assessments were not graded quantitatively, they provided qualitative evidence of students' development in communication, collaboration, and instructional competence aligned with the objectives of the co-creation model.

Co-creation structure and student role

In the 2022 lecture-based course, health promotion content was delivered through faculty-led symposia organized around major life-course stages, including child, adolescent, adult, and elderly health, with an emphasis on population-based prevention and multidisciplinary perspec-

tives. In contrast, the 2023 co-creation model organized learning into 10 student-led topics that spanned a broader range of community health domains, including life-course health, occupational and musculoskeletal health, oral health, community pharmacy, and psychosocial aspects of health.

The co-creation process was implemented through a structured nine-step sequence. Step 1: Topic Introduction involved faculty outlining the scope and relevance of the assigned community medicine topics and clarifying expectations for student-led learning. Step 2: Brainstorming and Planning required students to work within groups to define learning objectives, determine instructional approaches, and allocate roles and responsibilities. Step 3: Research and Content Development focused on independent literature review and preparation of preliminary teaching materials emphasizing key public health concepts. Step 4: Development of Examination Questions involved each group creating ten multiple-choice questions aligned with their topic, which were subsequently reviewed and modified by faculty for accuracy and alignment with course objectives. Step 5: Rehearsal and Refinement consisted of within-group practice teaching sessions and formative feedback from peers and instructors. Step 6: Inter-group Peer Practice Sessions allowed groups to present their content to other groups and receive reciprocal feedback. Step 7: Preparation of Final Materials involved revising teaching materials and logistical arrangements in response to feedback. Step 8: Formal Classroom Presentation required groups to deliver structured peer-teaching sessions during scheduled class time, with students assuming instructional roles and faculty acting primarily as facilitators. Step 9: Reflection and Discussion concluded the process through faculty-guided reflection, allowing students to consolidate learning, address content gaps, and reflect on their experiences as co-educators.

Although the organizational structure differed between cohorts, the thematic scope of community health promotion and disease prevention remained comparable. The 2023 topics were designed to map onto and expand upon

the life-course and population health principles addressed in the 2022 symposia, ensuring continuity in core content while allowing greater depth, contextualization, and student ownership of learning through co-creation.

Data collection

Two types of data were analyzed in this study. Examination data from 2022 and 2023 were retrieved from the PCMMC database, including total scores, mean, standard deviation (SD), median, minimum, maximum, and the 25th (P25) and 75th (P75) percentiles. The department calculated the retrieved scores from the raw scores. Since the exams do not share the same total score, they are first converted into percentages to standardize the data. For the 2023 cohort, survey data were also collected to evaluate students' perceptions of the co-creation approach. The survey consisted of closed-ended items, including five Likert-scale questions on the alignment of project objectives with expectations, the effectiveness of team communication, individual contribution, the perceived impact on personal and academic development, and overall satisfaction with the co-creation experience. One multiple-choice item asked whether students would recommend this approach to others (Yes/No/Maybe). In addition, open-ended questions invited students to provide a brief overview of their experience, identify challenges in collaboration, describe the skills or knowledge they gained, highlight the strengths of the approach, and offer any additional comments.

Statistical analysis

Examination data were analyzed using Microsoft Excel (Microsoft Corp., Redmond, WA, USA). Because the total exam scores differed between 2022 and 2023, relative measures of variability (relative standard deviation and coefficient of variation) were used for comparison. Because MCQ-based examinations primarily assess knowledge acquisition, they may not fully capture higher-order competencies, such as collaboration, creativity, facilitation skills, and professional identity development, as emphasized in the co-creation model.

Survey data were analyzed using descriptive statistics for closed-ended responses. Open-ended survey responses were analyzed using thematic analysis. Responses were reviewed iteratively, coded inductively, and grouped into recurring themes related to student engagement, teamwork, communication skills, creativity, and perceived learning gains. Themes were refined through repeated comparison to ensure consistency and relevance.

Ethical considerations

This study was reviewed and approved by the Board of the Royal Thai Army Medical Department (approval number M019h/68). The review process ensures that all research involving human participants complies with ethical standards for confidentiality, voluntary participation, and data protection. As the study used secondary, de-identified educational data and anonymous student surveys, it did not require individual informed consent.

All procedures were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and relevant institutional research guidelines.

Results

Characteristics of participants

A total of 95 Thai preclinical medical cadets (N = 95) enrolled in the third year of the undergraduate medical program participated in the study. The sample comprised 58.9% male and 41.1% female students, with ages ranging from 19 to 22 years (mean age = 20.75 years). All participants were registered in the Introduction to Community Medicine course.

Survey results

A total of 76 students (response rate 80%) completed the post-course survey evaluating their experience with the co-creation project. Overall, student perceptions were highly positive across all items (**Table 2**). Mean Likert-scale scores ranged from 4.50 to 4.62, indicating strong agreement that the co-creation project met expectations, facilitated effective communication, and supported personal and academic development. The highest-rated items were alignment of project objectives with expectations (4.62 ± 0.54) and overall satisfaction (4.57 ± 0.55).

Table 1. Comparison of the instructional approaches used in the Introduction to Community Medicine course in 2022 and 2023, highlighting differences in teaching format, student roles, learning emphasis, and assessment methods

Aspect	2022 Lecture-based approach	2023 Student co-creation approach
Teaching mode	Expert-led symposium	Collaborative, student-led learning
Structure	Fixed, faculty-defined topics	context-based topics within defined learning objectives
Health promotion focus	Life-course and disease prevention perspective	Community empowerment, participation, and contextual health promotion
Student role	Primary knowledge recipient	Active contributor and knowledge co-creator
Primary assessment focus	MCQ-based knowledge assessment	MCQ-based assessment supplemented by formative performance feedback and reflection
Learning emphasis	Emphasis on what health interventions are appropriate	Emphasis on how and why health decisions are developed collaboratively

Table 2. Survey results for student co-creation activities (N=76). Descriptive summary of student survey responses on the co-creation experience in community medicine education. Mean and standard deviation (SD) are presented for Likert-scale items*, and frequencies (n, %) for categorical responses.

	Mean ± SD (min-max) / n (%)
How well did the project objectives align with students' expectations?	4.62 ± 0.54 (3-5)
Rate the effectiveness of communication within the co-creation team.	4.57 ± 0.60 (3-5)
How would the student rate their contribution to the co-creation project?	4.58 ± 0.59 (3-5)
Did the student feel that students' opinions and ideas were valued and considered?	
Yes	60 (79.0%)
No	2 (2.6%)
Maybe	14 (18.4%)
Do the students feel the co-creation experience has positively contributed to personal and academic development?	4.50 ± 0.60 (3-5)
Overall, how satisfied are the students with the co-creation experience?	4.57 ± 0.55 (3-5)
Would the students recommend this co-creation approach to other students?	
Yes	52 (68.4%)
No	2 (2.6%)
Maybe	22 (29.0%)

* Scale: 1 = strongly disagree, 5 = strongly agree

Open-ended survey responses indicated that 70% of students described their experiences in terms of creativity, engagement, and peer interaction. Respondents frequently referred to activities such as designing quizzes, developing learning materials, facilitating peer discussions, and presenting content to classmates. Several students noted that assuming a teaching role differed from prior learning experiences and required active participation in delivering the content.

Seventy-nine percent of respondents reported that their opinions and ideas were considered during the co-creation process, and 95% reported gaining new skills or knowledge. The most commonly mentioned skills and knowledge included teamwork, communication, and approaches to explaining public health concepts. Student reflections frequently referenced collaboration among

group members and participation in shared learning activities.

Approximately 20% of respondents reported challenges related to group collaboration, including unequal workload distribution, differing viewpoints, and limited preparation time. Some respondents reported difficulties coordinating tasks or reaching consensus within their groups.

Regarding future implementation, 68.4% of respondents indicated that they would recommend the co-creation approach for subsequent cohorts. Approximately 80% commented on the project's organization and the role of faculty guidance. Suggestions for improvement were provided by around 60% of respondents, including requests for additional preparation time, clearer topic guidelines, and mechanisms to support more equitable workload distribution. The remaining respondents reported no additional suggestions.

Comparing examination results

A comparison of examination performance before and after implementing the co-creation approach showed a clear improvement in student outcomes. Mean examination scores increased from 41.0% in 2022 (lecture-based learning) to 56.2% in 2023 (student co-creation), demonstrating a statistically significant increase ($p < 0.001$) (**Figure 2**). The relative standard deviation decreased from 21.6% to 17.5%, indicating a reduction in score variability. Median scores rose from 40.0 to 56.0, with a broader range observed in the co-creation cohort (minimum 28, maximum 76) compared with the lecture-based cohort (minimum 26.7, maximum 63.3). The first and third quartiles (P25-P75) also improved from 36.7-49.2 to 52.0-64.0.

When expressed as the coefficient of variation, results decreased from 21.6% to 17.5%. The arithmetic means increased from 41.0% to 56.2%. These descriptive results indicate a higher mean score and lower variability in the co-creation cohort than in the lecture-based cohort.

Discussion

This educational case explored the implementation of a student co-creation model within a traditionally lecture-based community medicine course in a military medical education context. Findings from quantitative examination data and qualitative student feedback provide complementary insights into how students engaged with and experienced this pedagogical approach. Together, these data sources describe both assessed knowledge outcomes and experiential aspects of co-creation.

From a mixed-methods perspective, the quantitative and qualitative findings address related but distinct dimensions of learning. The MCQ-based examination primarily reflects knowledge acquisition and content understanding, whereas qualitative findings derived from open-ended survey responses illuminate learning processes, student roles, and perceived skill development. Rather than serving as direct correlational measures, these data sources collectively offer a broader understanding of learning

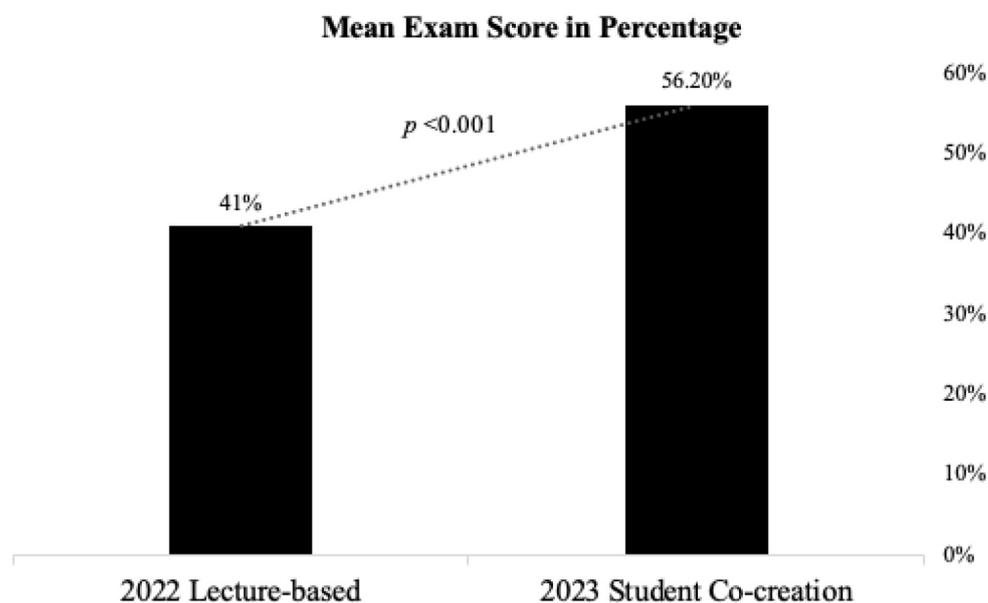


Figure 2. A bar chart comparing mean examination scores in Introduction to Community Medicine across two academic years. The mean score increased significantly from 41% ($n = 103$) in the 2022 lecture-based cohort to 56.2% ($n = 95$) in the 2023 student co-creation cohort ($p < 0.001$). This improvement indicates enhanced learning and greater consistency in performance following the implementation of the co-creation approach.

within a co-creation framework. Examination scores provide descriptive information about cognitive outcomes, whereas thematic analysis captures process-oriented aspects of learning that are not readily assessed by traditional written examinations.

Qualitative findings indicate that students experienced the co-creation process as involving active participation, shared responsibility, and peer-teaching engagement. Students described participating in content development, lesson planning, and peer instruction, which required coordination, discussion, and reflection. These experiences align with educational perspectives that conceptualize learning as a social and participatory process. However, although the examination assessed knowledge acquisition, it was not designed to measure collaborative, creative, or facilitation competencies central to co-creation pedagogy. Accordingly, examination results should be interpreted as one component of learning assessment rather than a comprehensive measure of all intended educational outcomes.

The qualitative findings observed in this study are consistent with prior literature on learner–educator partnerships in health professions education. Ambrosetti et al. reported that involving students as co-designers is associated with increased motivation and shared responsibility⁽¹⁵⁾. At the same time, Killam et al. described how co-created assessments support learner reflection and ownership.⁽¹⁶⁾ Suliman et al. identified associations between partnership models and learner well-being through belonging and autonomy,⁽¹⁶⁾ and Rae et al. discussed how co-creation may contribute to professional identity formation in clinical education contexts.⁽¹⁷⁾ These studies provide a theoretical context for interpreting the student experiences reported in the present study. Findings from this study also align with research on active and collaborative learning approaches in medical education. Fakoya et al. described associations between team-based and interactive learning and student engagement, while Divakaran reported that collaborative learning supports conceptual understanding.^(18, 19) Müller et al. highlighted how community-based learning experiences can influence medical students'

empathy and awareness of health inequities.⁽²⁰⁾ The present study adds descriptive evidence from a community medicine course in which students participated in instructional planning and peer teaching within a structured curriculum.

In a military medical school context, the feasibility of co-creation may depend on the intervention's structured design. Clearly defined topics, a sequenced nine-step process, and consistent faculty facilitation provided boundaries that supported student participation while maintaining academic rigor and institutional expectations. Faculty oversight and predefined learning objectives may have helped balance learner autonomy with the hierarchical culture characteristic of military education, allowing students to engage in co-creation without ambiguity regarding roles or responsibilities.

Several limitations should be acknowledged. As a descriptive, single-institution study using secondary data, causal inferences cannot be established. Differences in cohort characteristics and examination content may have influenced examination results, and outcomes were limited to a single course and short-term measures. In addition, the assessment strategy was primarily designed to evaluate cognitive learning outcomes and did not directly measure collaborative, creative, or facilitation competencies emphasized in the co-creation model. This study is a retrospective educational evaluation rather than a prospective curriculum development study.

Despite these limitations, this case study demonstrates the feasibility of implementing a structured student co-creation model in undergraduate community medicine education. The findings contribute descriptive evidence to ongoing discussions on learner partnership and participatory teaching approaches in health professions education. Future research employing longitudinal or controlled designs and assessment strategies aligned with co-creation competencies is warranted to further examine learning processes, professional development, and transferability across educational contexts.

Conclusion

This educational case describes the implementation of a student co-creation model within an undergraduate community medicine course in a military medical education setting. Using a mixed-methods approach, the study provides descriptive evidence on student learning experiences and assessed knowledge outcomes associated with this pedagogical approach. Quantitative examination data and qualitative student feedback offered complementary perspectives on learning, capturing both cognitive outcomes and experiential aspects of participation, responsibility, and peer teaching.

The findings suggest that structured student co-creation can be implemented within a traditionally hierarchical educational context when supported by clearly defined learning objectives, sequential processes, and consistent faculty facilitation. While MCQ-based examinations reflected knowledge acquisition, qualitative findings highlighted learning processes and competencies, such as collaboration, communication, and shared responsibility, that were not directly measured by written assessments. These results underscore the importance of aligning assessment strategies with the intended outcomes of participatory learning models.

As a descriptive, single-institution, retrospective evaluation, this study does not establish causal relationships or long-term educational impact. Nevertheless, it contributes contextualized insight into how learner partnership and co-creation may function in community medicine education. Future research employing longitudinal or controlled designs, along with assessment tools explicitly aligned with co-creation competencies, is warranted to further examine educational outcomes, professional development, and applicability across diverse institutional settings.

Disclosure statement

The authors report there are no competing interests to declare.

Author contributions

S.S. and P.N. conceptualization; S.S. methodology, formal analysis, validation, data

curation, visualization, and writing-original draft; P.N. project administration, supervision, resources, and writing-review and editing.

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