Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Operationalising Co-Creation in Health Professional Education: A PCC–IPO–Fishbone Analytical Framework

Sangeetha Kandasamy

sangeetha6482@gmail.com

IHPE,Sri Balaji Vidyapeeth & Government Villupuram Medical College,Villupuram,Tamilnadu.
https://orcid.org/0000-0001-8458-512X

S. Ragunathan

Sri Lalithambigai Medical College & Hospital

K.R. Sethuraman

Institute of Health Professions Education, Sri Balaji Vidyapeeth https://orcid.org/0000-0002-1547-0289

TSR.Anjana

Government Chengalpattu Medical College https://orcid.org/0000-0001-7886-4712

S. Kirubakaran

Government Omandurar Medical College https://orcid.org/0000-0003-4136-1331

Short Report

Keywords: Co-creation, IPO Model, Fishbone Analysis, Curriculum design

Posted Date: June 28th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-10149530/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: The authors declare no competing interests.

Abstract

Background: Nowadays, co-creation in health profession education is recognised as an emerging approach to enhance collaboration between learners and faculty. However, there is a need for structured frameworks to operationalise co-creation in curriculum design effectively**.** This study aimed to implement and analyse a structured co-creation workshop using an integrated Population-Context-Input-Process-Output and fishbone framework to promote collaborative learning.

Methods: An exploratory educational intervention was conducted among a diverse group of 13 medical undergraduate and 4 postgraduate learners and 15 faculty. They were divided into 5 heterogeneous groups and the workshop followed a six-stage process: ice-breaking activity, trigger scenario for gap analysis, guided discussion, Fishbone analysis integrated with the IPO model, solution generation and group presentation and reflection. Participants worked collaboratively to identify root causes of educational challenges and propose feasible solutions. Data were collected through participants' outputs, observations and structured feedback.

Results: All 5 groups completed the cocreation activity, identifying educational /patient safety practices gaps and generating collaborative solutions. Thematic analysis showed three major themes - partnership, teamwork and shared responsibility. The integration of the PCC- IPO- Fishbone framework enabled systematic identification of root causes related to curriculum design, communication gaps, institutional factors, and learner engagement. Participants proposed context-specific solutions to improve the learning outcomes and patient safety. Participants' feedback demonstrated a high level of satisfaction, more than 75% of the participants rated the workshop as highly relevant, well-organised and engaging. Most of them reported that the cocreation workshop exceeded their expectations and enhanced their understanding of collaborative curriculum design.

Conclusion: The PCC-IPO-fishbone framework provides a structured and feasible approach to operationalising co-creation in medical education. It fosters stakeholder engagement, critical thinking, and collaborative problem-solving, supporting its potential for curriculum innovation and capacity building.

Introduction

Health professional education is undergoing rapid transformation driven by changing patient expectations, information technologies, complex health systems, and the growing prominence of professionalism, teamwork, and humanistic care. These shifts demand not only curricular reform but also a rethink of how medical education can be designed.[1, 2, 3] In traditional educational models, where faculty and administrative staff alone design curricula and learners passively receive content, this may be increasingly misaligned with the competencies required for the future of healthcare professionals. Co-creation is a structured collaboration among learners, educators, and patients, characterised by active partnership among learners. It is an essential strategy for preparing future physicians who are

adaptable, effective, and accountable to society. The structuring of collaborative components includes shaping learning objectives, teaching methodologies, assessment tools and educational resources. A bilateral partnership that encourages learners to navigate the complexities of healthcare systems actively.[4, 5, 6] Unlike feedback approaches, cocreation involves shared decision-making, mutual respect, and joint ownership of educational processes and psychological safety.[6] Faculty development programs play an important role in strengthening the adoption of innovative educational approaches. At the same time, students contribute insights into relevance, feasibility, and learners' experiences. The roles of the learner and facilitator should include predefined operational procedures to gain experiential knowledge of the learning environment and faculty, as well as disciplinary expertise, professional standards, and patient safety priorities.[7, 8]Co-creation improves the learning processes, enhances engagement and promotes active architects of their own professional identity when implemented within clear structures that meet the cultural demands and supportive institutional polices also. This capacity-building for the complex healthcare system aligns with contemporary educational theory that emphasises learner agency, social constructivism and participatory design, and supports the United Nations Sustainable Development Goals.[9]

Why do we need a co-creation model in health professional education;

1. Preparing the adaptive and self-directed learning, critical thinking to cover medical knowledge expansion to real practice of decision-making processes. engage in lifelong learning. breaking silos into mirrors of real clinical practice. mitigating institutional barriers utilizing structured theoretical frameworks to guide stakeholder engagement.
2. Co-designed educational intervention shows improvements in students' motivation, confidence, self-efficacy, key attributes of future physicians working in certain environments.[10]
3. Today, Gen Z learners are living in a technology-driven environment in all aspects, so healthcare complex system can be simplified by involving students in educational design to promote their metacognition, curriculum matching patient safety. Example video-based model or prototype model for the usage of insulin therapy or respiratory therapy. [11]
4. Most of the health professional students joined from diverse backgrounds with different learning styles and different aspirations. Co-creation enables a better response to these differences by identifying bottlenecks in learning, hidden curriculum issues and gaps between theory and practices that faculty may overlook. Incorporating their perspectives leads to education that is more relevant, equitable, and context-sensitive.
5. Co creation is misunderstood as limited to teaching methods or curriculum review; it can be co-constructed OSCE checklist rubrics improvements aligned with expected competence levels, a working model with patient information materials and simulation scenarios

6. Involving a curriculum committee member, actually, it is one representative by National Medical Council in India, but the roles and responsibilities of the student are not highlighted. It can be escalated to the next level with quality assurance processes .
7. Build their leadership and institutional trust. Co-creation is the idea that through bringing together individuals with different roles, backgrounds, and experiences, institutions can generate innovative ideas and approaches. [12]

The co-creation in medical education is an emerging novel pedagogical approach in which students, faculty, patients and other stakeholders collaboratively design partnership-based education. These concepts are rooted in participatory research PAR by Kurt Lewin in 1940, considered as collaborative inquiry and participatory learning.[13]This idea later developed as students as partners in higher education in the early 2010s, principles to curriculum development, assessment design, and learning innovation to improve relevance, engagement, and shared ownership of learning. Although the approach is gaining momentum, empirical applications in health-professional education remain limited and are mostly reported as small-scale institutional initiatives. [14, 15, 16] Building on this evolving paradigm, the present study aims to implement a co-creation learning approach using the Population Context Concept to chunk the problem, system approach - Input Process Out and Fishbone framework to categorise the issues from identifying learning gaps to improve the safety, and collaboratively design educational solutions (Figure.1).

Research questions

1. How is co-creation implemented in undergraduate medical education?
2. What roles do students and faculty play in co-creating learning activities?
3. What are the processes involved in student–faculty co-design of medical education sessions?

Methodology

Study design

This exploratory education intervention study was conducted as part of a faculty development program in a medical college of tertiary care setup and incorporated a participatory problem-based learning activity to engage both faculty and students in collaborative discussion and solution generation

Study participants

The 5-hour co creation workshop included an interdisciplinary group consisting of 13 undergraduates, 4 postgraduates and 15 medical faculty trained in medical education technology who were divided into small groups of 6 to 7 mixed academic hierarchy team members and engaged in activities using PCC, IPO and Fishbone frameworks. The participants were enrolled on a purely voluntary basis and had a novice level of knowledge in the co-creation model in medical education.

The involvement of participants from different academic levels facilitated collaborative discussion, shared learning, and the integration of diverse perspectives during the process. The workshop was framed into three sequential learning sessions of exposure, an immersion phase and mastery level with hands-on activities. In the exposure phase session, a heterogeneous group was introduced with an icebreaker activity, in which they used coloured clay sticks to construct a visual representation of their understanding of co-creation in health profession education. This collaborative exercise encouraged participants to express their ideas visually, reduced hierarchical barriers, and fostered an environment of open, collaborative thinking. Subsequently, in the immersion phase, each group was provided with trigger scenarios such as first MBBS professional year diabetic food plate planning, Second MBBS professional year accident emergency registry maintenance and final MBBS snake bite management. Participants either worked with trigger scenarios or developed their own scenarios based on difficulties encountered in routine educational challenges or applied them to patient safety curriculum experiences, especially those faced during the internship or resident period.

Table 1 presents the event framework, which includes trigger scenarios that encouraged participants to engage as collaborative partners, with faculty acting as facilitators and learners taking an active role in designing innovative educational solutions. Participants analysed these scenarios by identifying the relevant stakeholders, context, and underlying concepts, aligning their discussion with the Population-Context-Concepts (PCC) framework. Each group interpreted the scenario and proposed solutions grounded in the Input, Process and Output model or kern six step approaches for co-creation. Finally, discussion prompts support and guide them in summarising, using a fishbone diagram to illustrate the factors influencing the problem and their proposed solutions at the mastery level. From each group, the undergraduates presented their findings and reflections to the other participants, facilitating shared learning and collective discussion. At the end of the workshop, participants completed a structured feedback questionnaire that included Likert scale items assessing relevance, overall satisfaction, and open-ended questions for comments and suggestions. Quantitative feedback data were summarised using descriptive statistics like frequencies and percentages. Open ended comments and workshop reflections were reviewed independently by the investigators and analysed using an inductive thematic approach.(Fig. 2.B)

Quantitative feedback data were summarised using descriptive statistics (frequencies and percentages). Responses to open-ended questions, facilitator observations, and group outputs were reviewed independently by the investigators and analysed using an inductive thematic approach. Recurring patterns and concepts were identified, grouped into categories, and refined into overarching themes through discussion and consensus among the authors.Open-ended comments and workshop reflections were reviewed descriptively to identify commonly reported perceptions and experiences related to the co-creation process.To enhance methodological rigor quantitative findings were integrated with qualitative data through triangulation.

Results

The co-creation workshop facilitated active interaction among participants and highlighted themes such as partnership, teamwork, and shared responsibility. The structured six-stage approach of the co-creation workshop, beginning with the Icebreaker activity, promoted teamwork and mutual respect among participants from academically heterogeneous groups. Figure. 2.B. showing that recurring pattern concepts were identified and grouped into categories, highlighting partnership, teamwork, and shared responsibility. Table. 1 shows the progression of workshop from the educational gaps to developing and presenting collaborative solutions, followed by a reflective discussion based on the trigger scenarios. Guided discussion prompts and the use of a fishbone diagram enabled us to systematically analyse the issue and categorise the problem in multiple dimensions. Figure 1. In a fishbone diagram, the "thorns" represented potential causes while the head indicated the expected outcome. This helped navigate the co-creation with illustration and group presentations, and reflections facilitated shared learning and refinement of ideas.

The workshop feedback demonstrated a highly positive perception of the workshop in both quantitative and qualitative terms.(Fig. 2&3) The feedback focuses on importance, relevance to the work, clarity of the content, resource material, facilitator engagement and overall event organisation. The majority of the participants reported that very satisfied (83.3%)with the workshop and rated the content as extremely useful (94.1%). Most respondents indicated that the workshop exceeded their expectations with its very clear and understandable(88.9%). The facilitators were perceived as extremely engaging(77.8%), and activities were considered useful for learning by most participants, with open-ended feedback.

Discussion

Capacity building research contributes to the achievement of Sustainable Development Goal 17 - Partnership for goals by strengthening skills ,technology and institutional capacity to support evidence-based research and innovation in health and higher education.[17] Cocreation in medical education has evolved as a collaborative approach in which learners and facilitators combine to design and evaluate educational experiences. Unlikely to be traditional teacher-centred models; co-creation promotes learners as partners, enhancing engagement and responsibility in shaping curriculum goals, learning activities, and assessment strategies. Few studies in health professional education highlight that involving learners promotes deeper learning and produces curricula that are more responsive to integrated clinical services and the delivery of the biopsychosocial model.[18] This study's findings align with Agnello et al developed a co-creation Rainbow framework to evaluate stakeholders' participation (engage, participate, empower) and co-creation stages (informing, understanding, stimulation, collaborating, collective decision. [19, 20, 21]

In contrast, our study explores a more operational and structured analysis process integration by population context concept (PCC) framework and fishbone analysis for identifying systemic root causes, thereby guiding participants from contextual problem identification to a design-structured context-relevant intervention. While most of the co-creation in health professional education emphasises collaboration and participatory curriculum design, which lacks a structured framework to guide the

participation, in contrast, the PCC framework explicitly identifies the problem framing processes by grounding discussions in specific educational settings and stakeholders' needs. PCC acted as an initial analytical step that guided the subsequent stages of the cocreation process rather than a simple checklist. This PCC framework is mainly used for research methodology and interprofessional education curriculum designs. Another innovative aspect of the study system's approach such as input process output framework and visual representation by fishbone analysis about co-creation design. The usage of fishbone diagrams in this workshop allows them to analyse the system failures in Competency-based curriculum, training gaps, institutional culture and cognitive biases identification, which promoted better learning outcomes and ensure the integrated holistic patient safety. The workshop facilitated cross and reflective group discussions and enabled participants to share diverse perspectives and refine their ideas. Such iterative dialogue and feedback rating support mutual respect, psychological safety, and shared ownership considered essential for effective cocreation in health professional education.

Compared with previously reported co-creation models, this methodology offers a more scaffolded design that guides participants from problem identification to system-level analysis and collaborative solution development. Findings of this study support previous literature highlighting the value of student–faculty collaboration in designing educational activities. Co-design or student–staff partnership enables learners to actively contribute to curriculum development, assessment design, and learning activities, thereby enhancing engagement and the relevance of training in health professional education.

There is growing evidence supporting the value of co-creation and student partnerships in the design of mainly Western medical schools, and very limited exposure in South Asian countries. However, a 2025 scoping review identified only a small number of empirical studies on co-design in the health professional field, indicating limited evidence and guidance to effectively implement and sustain such partnerships. Co-creating patient educational materials on protein energy malnutrition (PEM) and fostering interprofessional education and collaboration identified key best practices such as frameworks involving students, patients and clinicians early and applying evaluation tools while emphasising the need for clearer definitions and standardised methods.

Conclusion

This exploratory study mainly focuses on a workshop on capacity building, demonstrating the feasibility of applying a co-creation approach to engage faculty and undergraduates in collaboratively identifying educational challenges and generating solutions. The structured activities, including PCC framing, fishbone analysis, and group reflection, facilitated meaningful dialogue and a sense of shared responsibility. Although this short intervention, the workshop highlighted the potential co-design strategies to strengthen collaborative, curriculum improvement and patient educational materials. Future studies with larger groups and longitudinal evaluation are required to assess the sustained impact of co-created educational initiatives on teaching practices and learning outcomes.

Declarations

Ethical consideration:

The study was approved by the Institutional Ethics Committee of (IEC no: Dr. MGR-ERI/SLMCH/2026/045). Oral and written informed consent were obtained from all participants before the initiation of the study. Participants' responses, confidentiality and anonymity were maintained throughout the sessions.

Limitation:

The study was conducted in a single institution with a small sample size. Participant perceptions were measured using a non-validated feedback questionnaire immediately after the workshop and long-term educational outcomes were not assessed.

Conflict of Interest: Nil

Funding source: Nil

References

1. Guze PA (2015) Using Technology to Meet the Challenges of Medical Education. Trans Am Clin Climatol Assoc 126:260–270 PMID: 26330687; PMCID: PMC4530721
2. Hays RB, Ramani S, Hassell A (2020) Healthcare systems and the sciences of health professional education. Adv Health Sci Educ Theory Pract 25(5):1149–1162. 10.1007/s10459-020-10010-1. Epub 2020 Nov 18. PMID: 33206272; PMCID: PMC7672408
3. Thibault GE (2020) The future of health professions education: Emerging trends in the United States. FASEB Bioadv 2(12):685–694. 10.1096/fba.2020-00061. PMID: 33336156; PMCID: PMC7734422
4. Al-Bualy R, Suliman S, de Mortier CA, Hancock NJ, Iqbal MZ, Mathew T, Sriranga J, Susilo AP, Könings KD (2026) Co-creation in health professions education: Triangulating perspectives and processes for deeper insights. GMS J Med Educ 43(1):Doc2. 10.3205/zma001796. PMID: 41657927; PMCID: PMC12875057
5. Killam LA, Egan R, Godfrey C, Ross-White A, Camargo-Plazas P, Lock M, Luctkar-Flude M (2024) PROTOCOL: Learner-educator co-creation of student assessment in health professional education courses: A scoping review protocol. Campbell Syst Rev 20(2):e1392. 10.1002/cl2.1392. PMID: 38510060; PMCID: PMC10951880
6. Stoddard HA, Lee AC, Gooding HC (2025) Apr-May;37(2):261–267 Empowerment of Learners through Curriculum Co-Creation: Practical Implications of a Radical Educational Theory. Teach Learn Med. doi: 10.1080/10401334.2024.2313212. Epub 2024 Feb 8. PMID: 38332636
7. Pereza N, Hauser G, Dević Pavlić S, Marić I, Sotošek V, Grgasović T, Mršić-Pelčić J (2025) How to create a faculty development program that transforms medical education according to actual institutional needs: evidence-based approach and experience at the University of Rijeka, Faculty of

Medicine, Croatia. Front Med (Lausanne) 12:1513119. 10.3389/fmed.2025.1513119. PMID: 40041468; PMCID: PMC11876177

8. Ahmed AI, Batt AM (2025) Exploring faculty development initiatives in medical education in resource-limited settings: perspectives and challenges. BMC Med Educ 25(1):1501. 10.1186/s12909-025-07848-7. PMID: 41146191; PMCID: PMC12560284
9. Burdick WP, Morahan PS, Norcini JJ (2007) Capacity building in medical education and health outcomes in developing countries: the missing link. Educ Health (Abingdon) 20(3):65 Epub 2007 Nov 20. PMID: 18080954
10. Suppawittaya P, Khowsathit P, Leelasithorn S, Sitthirat P, Kaewkamjornchai P (2026) Early exposure to a primary care course: a co-created transformative approach in health systems science. Med Educ Online 31(1):2622839. 10.1080/10872981.2026.2622839. Epub 2026 Jan 29. PMID: 41609139; PMCID: PMC12857692
11. Amini M, Rezaee R, Kojuri J (2025) How to Teach Generation Z Students: Reflections from Medical Educators. J Adv Med Educ Prof 13(4):257–258. 10.30476/jamp.2025.108312.2245. PMID: 41215991; PMCID: PMC12596426
12. Kallio JM, Halverson RR (2020) Designing for Trust-Building Interactions in the Initiation of a Networked Improvement Community. Front Educ 4:154. 10.3389/feduc.2019.00154
13. Ambrosetti É, Gaudin C, Flandin S, Poizat G (2025) Students as co-designers in health professional education: a scoping review. BMC Med Educ 25(1):645 Published 2025 May 3. 10.1186/s12909-025-07110-0
14. Kjellström S, Sarre S, Masterson D (2024) The complexity of leadership in coproduction practices: a guiding framework based on a systematic literature review. BMC Health Serv Res 24(1):219 Published 2024 Feb 17. 10.1186/s12913-024-10549-4
15. Felten P, Bovill C, Cook-Sather A (2014) Engaging students as partners in learning and teaching (1): benefits and challenges–what do we know? Int J Acad Dev 19(Suppl 1):6–8
16. Barradell S, Bell A (2021) Is health professional education making the most of the idea of 'students as partners'? Insights from a qualitative research synthesis. Adv Health Sci Educ Theory Pract 26(2):513–580. 10.1007/s10459-020-09998-3. Epub 2020 Oct 21. PMID: 33089396
17. United Nations (2015) Sustainble Development Goals17:Parterships for Goals.In Transforming our world:the 2030 Agenda for Sustainable Development. NewYork United Nations. https://sdgs.un.org/goals/goal17
18. Yong FR, Martin P, Wallis KA et al (2025) General practice specialty decision making: a system-level Australian qualitative study. *BJGP Open*. ;9(3):BJGPO.2024.0218. Published 2025 Oct 27. 10.3399/BJGPO.2024.0218
19. Agnello DM, Smith N, Vogelsang M et al (2025) Developing and validating the co-creation rainbow framework for intrinsic evaluation of methods: a health CASCADE structured review of models representing co-creation principles. *Health Res Policy Syst*. ;23(1):127. Published 2025 Oct 10. 10.1186/s12961-025-01381-1

20. Abbonizio J, Palermo C, Brand G, Buus N, Fossey E, Dart J (2025) Co-designing formal health professions curriculum in partnership with students: A scoping review. Med Teach 47(3):413–424 Epub 2024 Apr 15. PMID: 38621357
21. McDonald IR, Blocker ES, Weyman EA, Smith N, Dwyer AA (2023) What Are the Best Practices for Co-Creating Patient-Facing Educational Materials? A Scoping Review of the Literature. Healthc (Basel) 11(19):2615. 10.3390/healthcare11192615. PMID: 37830651; PMCID: PMC10572900

Table 1

Table.1.Framework and sequential activities of the co-creation workshop

Stage	Description	Results
Icebreaker activity - clay modelling and partner	Participants paired and discussed their perspectives on cocreation for collaborative learning. The clay model represented their visual understanding of cocreation in medical education.	Participants' initial perception of cocreation and visual expressed ideas partnership, teamwork, shared responsibility and mutual respect, ownership from learners. The activity facilitated interaction and helped break the heterogeneous academic hierarchy, becoming comfortable working collaboratively, so they were named " collaborators"
Problem Trigger Scenario-	A structured scenario related to challenges in medical education was distributed to stimulate critical thinking and discussion among participants	Collaborators identified key gaps between theory and clinical or limited student engagement in teaching and the need for collaborative problem-solving.
PCC framework analysis	Groups were asked to examine the problem using this framework systematically	Groups analysed the key stakeholders involved, the concepts of educational or patient safety issues, and the context in which the problem occurred, either in a clinical or classroom setting.
Discussion prompts- Guided group discussion	Groups were provided with five prompts to guide the analysis of the scenario. This approach ensured that problems were not overlooked and facilitated more organised exploration of potential solutions to improve co-creation designs.	Group discussions generated multiple perspectives on the issue. Participants, relevant stakeholders, barriers and proposed collaborative strategies.
Fishbone analysis with IPO Model	This stage helps collaborators visually organise and categorise the various factors contributing to an issue from multiple dimensions, rather than focusing on surface level. By integrating IPO model, it supported collaborative reflection and helped to propose feasible co-created strategies.	Groups were identified with root causes related to curriculum design, teaching methods, communication gaps, cultural diversity and institutional factors. The proposed co-created strategies to improve learning outcomes and collaborative engagement
Presentation and reflection- sharing of outcomes	Each group presented their analysis, followed by discussion and feedback from other participants.	Most of the undergraduates presented shared diverse solutions, which was preliminary insights that require further discussion and refinement. However, the activity encouraged collaborative reflection and highlighted the value of student-faculty partnership in improving outcomes.

Figures

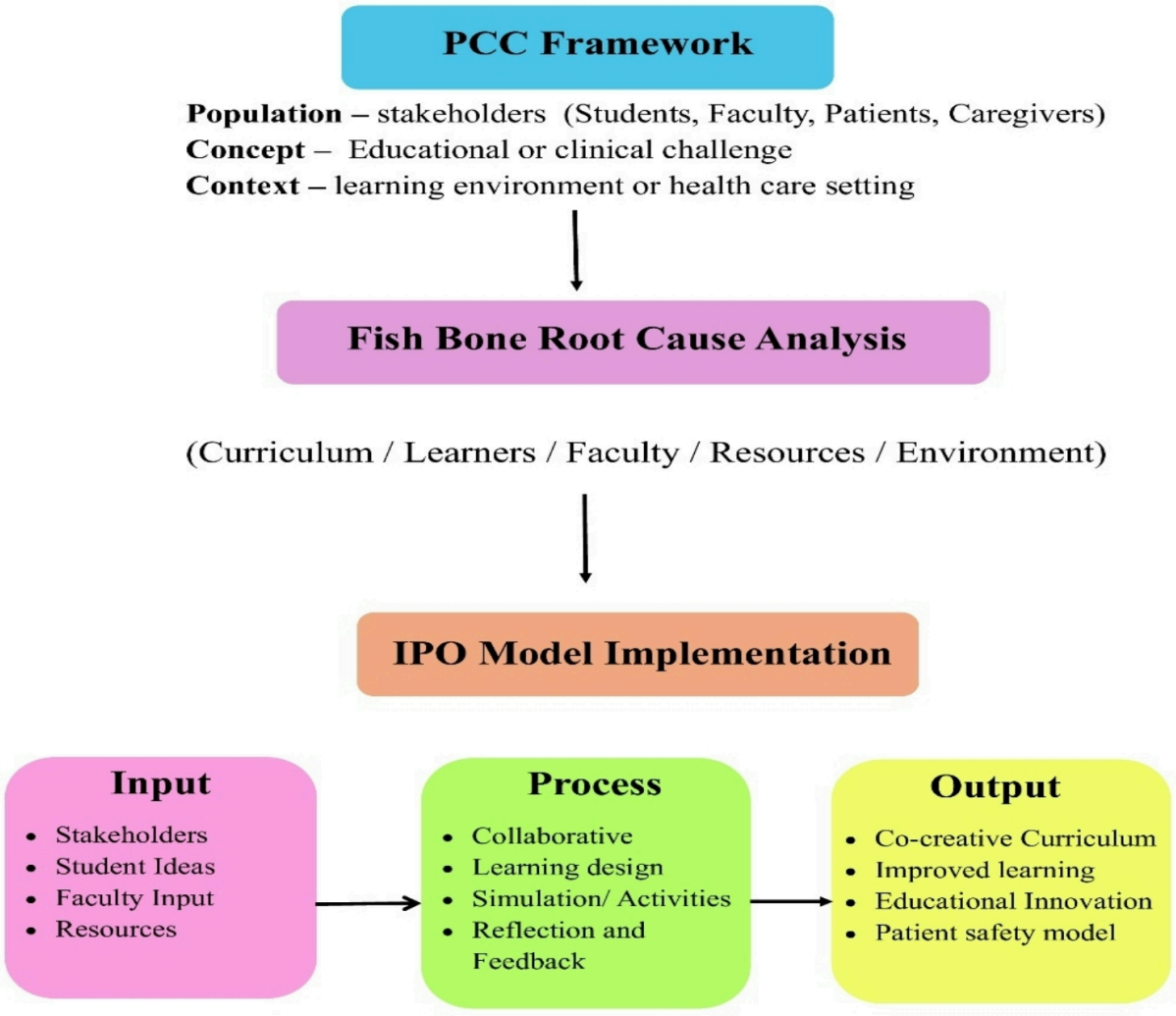


Figure 1

Co-Creation Health Education Model

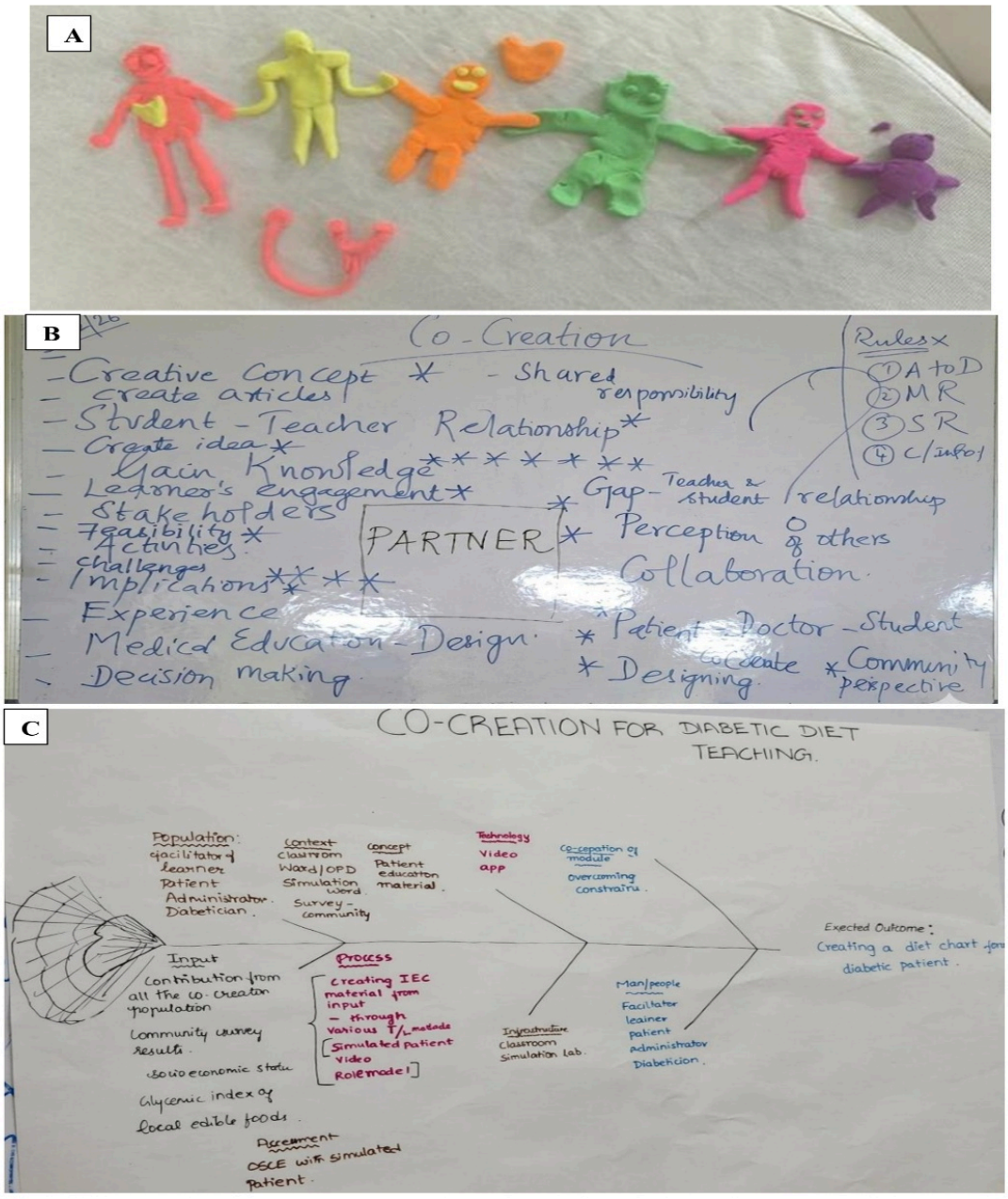


Figure 2

Co-creation workshop activities.

A.Clay-model activity representing collaborators, shared responsibility

B. Brainstorming session key concepts of co-creation and student–teacher partnership.

C.Fishbone diagram illustrating the co-creation framework for diabetic diet teaching.

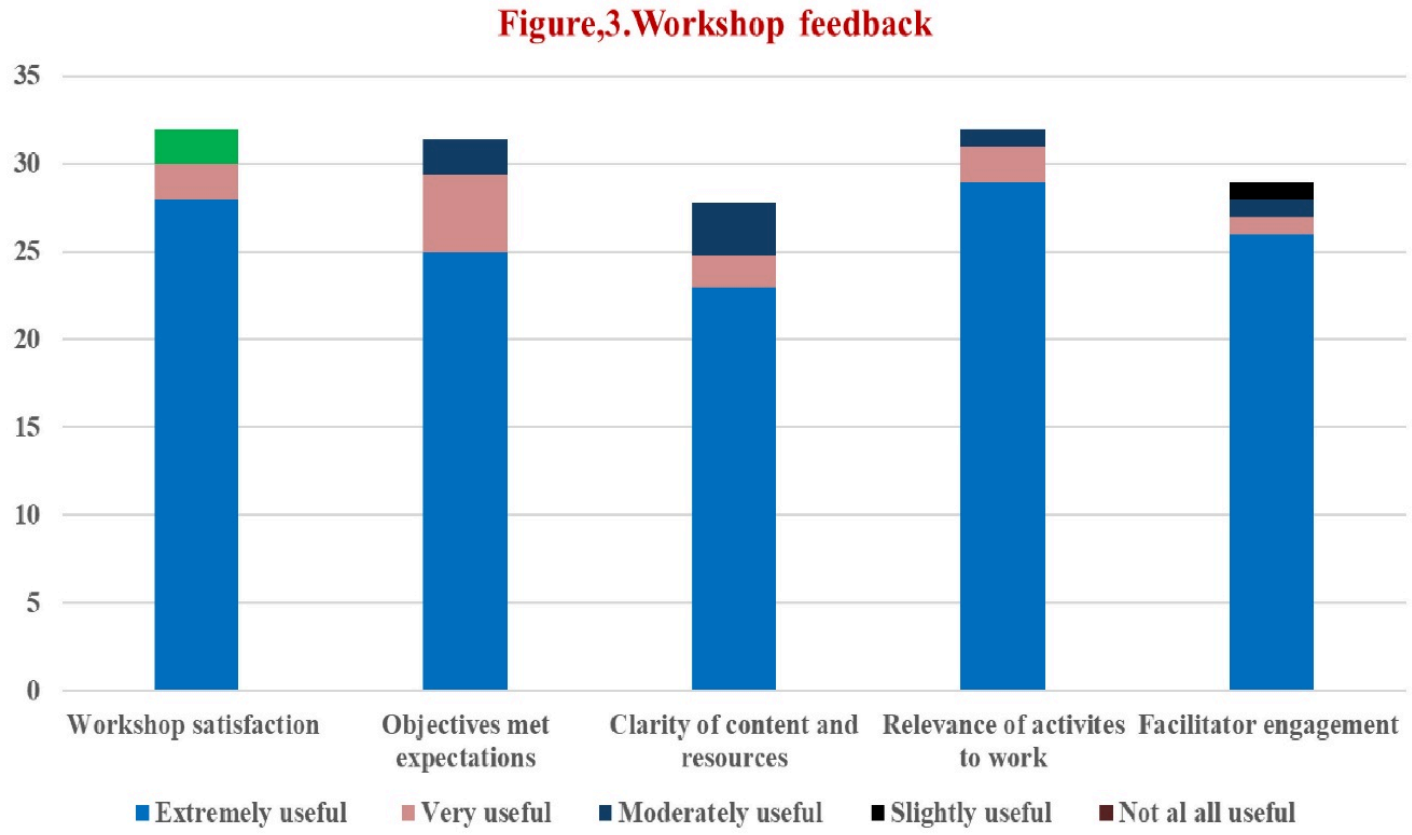


Figure 3

See image above for figure legend