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Jigsaw Approach to Teaching Clinical Examination: An Experience in a Simulation Setting

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ABSTRACT

Mastering physical examination is essential in undergraduate medical education, yet bedside teaching is often limited by patient availability and inconsistent exposure. Cooperative learning strategies, such as the Jigsaw Method, are well-studied in classroom contexts, but their use in clinical or simulation settings remains underexplored. Thus, this study evaluated the integration of the Jigsaw approach into simulated clinical examination teaching to enhance student learning. A mixed-methods design was employed. Fifty-four clinical-year medical students participated in Jigsaw-based simulated training from 2022 to 2023. Data were collected through an online questionnaire comprising a 5-point Likert scale on perceptions of learning and open-ended reflections for qualitative analysis. Quantitative data were analysed descriptively, while reflections were subjected to thematic analysis. Most students agreed the session was interesting (88.9%), well-organised (87%), relevant in content and materials (94.4%), and delivered effectively (90.7%). A minority (13%, n = 7) requested more time for hands-on practice, suggesting that station duration constrained skills acquisition. Qualitative analysis generated two themes: (a) attributes of effective clinical examination teaching; and (b) benefits of effective clinical examination teaching to students. In conclusion, Year 4 Family Medicine students at Universiti Sultan Zainal Abidin (UniSZA) perceived the Jigsaw approach in a simulation setting as engaging and beneficial for their learning. These findings provide preliminary evidence supporting future longitudinal evaluations and multi-institutional trials to assess the broader impact of this model in clinical education.

Keywords: *Jigsaw method, Medical students, Physical examination, Clinical clerkship, Simulation training*

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INTRODUCTION

Clinical examination and reasoning are fundamental skills in undergraduate medical education, traditionally delivered through bedside teaching with real patients. Although authentic, this method faces systemic barriers such as limited hospital support, patient availability, clinician workload, and environmental restrictions (1). Insufficient supervision, limited faculty training in learner-centred approaches, and varying levels of student readiness for self-directed learning further reduce its effectiveness (2–4). These barriers

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hinder experiential learning, which is essential for competency development. On the other hand, structured simulation provides a controlled and flexible environment where educators can adjust case complexity, define learning objectives, and manage time efficiently, thus ensuring more focused learning opportunities (5).

Simulation-based education complements bedside teaching by providing structured practice with defined outcomes, adjustable case complexity, and dedicated learning time (5). Cooperative strategies such as the Jigsaw Method are particularly relevant in clinical training, as they enhance peer teaching, accountability, and engagement. Originally developed by Aronson in the 1970s, the method has evolved into various models, including the Subject Jigsaw (6). Both approaches use home and expert groups, where learners study assigned content and then teach peers, fostering collaboration and knowledge sharing (6,7). While the classic model emphasised social integration, the Subject Jigsaw adapts roles to support discipline-specific and in-depth learning, making it well-suited to higher education and technical fields (8,9). In this variant, students first master material in expert groups before teaching home groups, reinforcing teamwork, responsibility, and self-directed learning (9,10). Therefore, simulation and Jigsaw address barriers to consistent, high-quality clinical examination training.

Competent and context-appropriate clinical examination is vital for safe decision-making in family medicine and is mandated in Malaysia's outcome-based curriculum (11). However, bedside performance among clerkship students is often inconsistent due to unstructured, supervisor-dependent teaching in busy public clinics (12). These environments score poorly on the Undergraduate Clinical Education Environment Measure, as clinical exposure alone rarely ensures reliable skill acquisition (12). Challenges are compounded by inadequate self-directed learning (SDL) preparedness, dependence on teacher prompts (2), and variability in teaching quality, with many clinicians lacking training in learner-centred methods and constructive feedback skills (3). High patient volumes further disrupt the experiential learning cycle needed for competence development (4).

Cooperative learning strategies such as the Jigsaw Method address these challenges by requiring students to master, teach, and integrate examination components by promoting standardisation, SDL, peer teaching, and teamwork (10). Evidence shows that Jigsaw enhances knowledge, engagement, and collaboration in preclinical education (13). However, its use in health professions education remains limited, with no application to clinical skills training. A review of 69 studies identified only six using the Subject Jigsaw model, all in non-clinical contexts (6). While the classic Jigsaw improves teamwork and short-term knowledge in preclinical learners (10,13), its impact on hands-on clinical skills is unknown. This study therefore aimed to evaluate Year 4 medical students' perceptions during the Family Medicine posting at Universiti Sultan Zainal Abidin (UniSZA) regarding the integration of the Subject Jigsaw into simulated clinical examination teaching, and to assess its feasibility as a curriculum innovation.

Evaluations of the Subject Jigsaw in primary care clerkships remain limited, despite growing interest in peer teaching within guided simulation. Effective implementation requires standardised sessions, structured self-directed learning, trained facilitators, and institutional support with adequate simulation resources (14). By integrating Jigsaw with simulation, this study contributes to the Scholarship of Teaching and Learning (SoTL) by providing the feasibility evidence for a structured, peer-led model in medical education. The findings are intended to guide curriculum design, support faculty development, and inform future longitudinal and multi-institutional studies to strengthen clinical training.

METHODS

This study used an explanatory sequential mixed-methods design. Quantitative data from Likert-scale surveys were analysed descriptively, followed by thematic analysis of written reflections to contextualise findings. The study was conducted among fourth-year medical students at UniSZA, during their six-week primary care clerkship. Each cohort of 58 to 60 students was divided into four rotation groups of 15 to 16.

Teaching Delivery

Clinical examination skills were traditionally taught in eight clinic-based sessions during the six-week primary care clerkship. To improve engagement and effectiveness, we introduced an additional simulation-based session using the Subject Jigsaw method at the start of the posting (Figure 1). Students were divided into expert groups of four to five and provided instructional materials one week in advance.

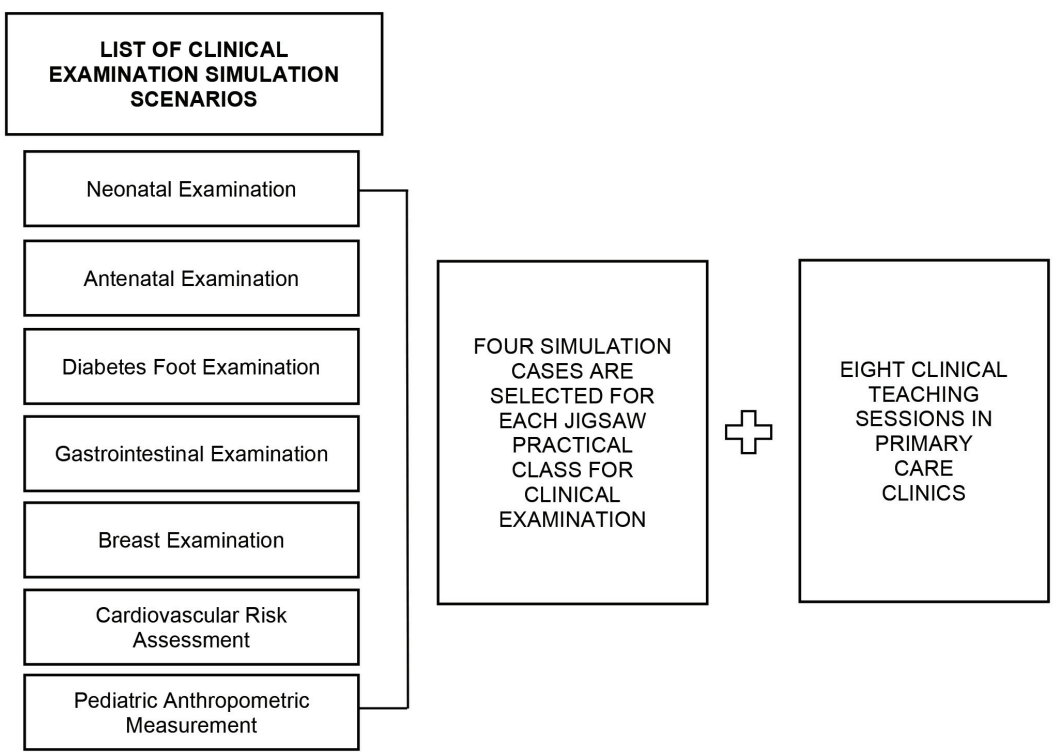


Figure 1: Structure of clinical examination training during the 6-week primary care clerkship.

Participants

All students participating in the Jigsaw practical session for clinical examination teaching were invited to join this study. The study was conducted over more than one year and involved the entire batch of fourth-year medical students for the 2022/2023 session, with 54 of 58 students responding to the survey. As the dropout rate was less than 10%, which is generally acceptable in survey-based educational studies (15), no further assessment of non-responders or response bias was undertaken.

Pre-class Materials and Instructions

Figure 2 outlines the subject Jigsaw workflow used to enhance engagement and clinical examination learning. In each family medicine posting, students completed a 2-hour simulation session in home groups of four, following best-practice guidelines for simulation teaching (16) and meeting Malaysian Medical Council and Malaysian Qualifications Agency standards for small-group training (11,17). Each student was assigned one of four examination topics, namely neonatal, gastrointestinal, breast, or diabetic foot, and received preparatory materials one week in advance to support self-directed learning.

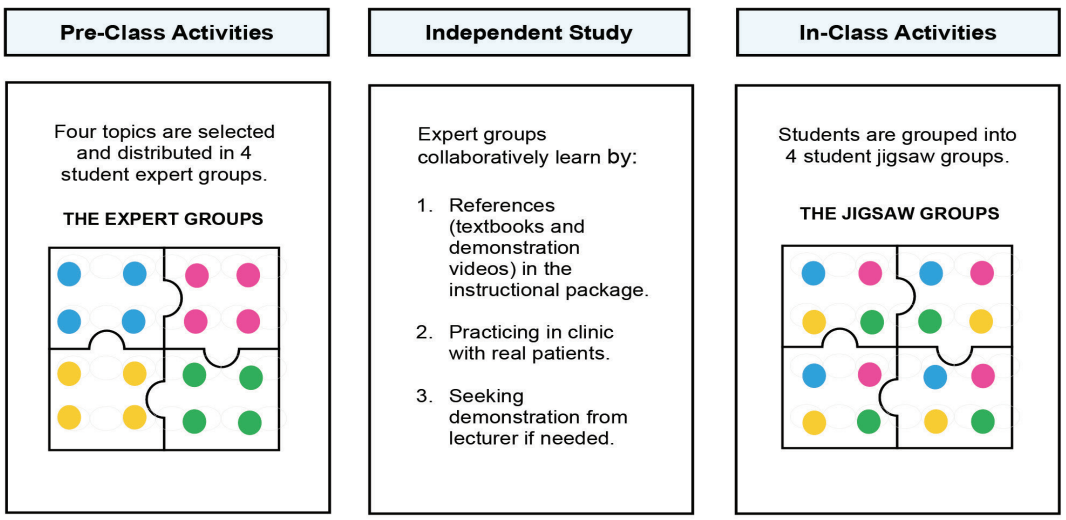


Figure 2: The process of Jigsaw classroom design.

In-class Activities

The 2-hour clinical skills lab was divided into four 30-minute sessions, each dedicated to a specific clinical skill. Within each, 5 minutes were used for demonstration, 15 minutes for supervised practice with manikins, and 10 minutes for discussion. This format, adapted from best-practice recommendations in simulation-based education (16), emphasises demonstration, extended practice, and structured debriefing. It also complies with the Malaysian Medical Council and Malaysian Qualifications Agency standards for small-group training (11,17). Formative assessment activities were included to reinforce learning.

Four simulation stations were prepared by lecturers and lab staff, with students rotating through each. At each station, an expert student presented a scenario, outlined objectives, and guided the examination using a manikin and a structured checklist. To reduce variability and role bias, standardised materials and checklists were provided to all expert students. Lecturers supervised sessions and provided real-time feedback to ensure accuracy and balance in the peer-led process.

After the hands-on practice, the expert student facilitated discussions on clinical findings and potential diagnoses, encouraging application of theoretical knowledge. A supervising lecturer provided real-time feedback and support throughout. The session concluded with

a structured debriefing to reinforce learning objectives, promote reflection, and prepare students for real clinical encounters through an interactive, peer-led, and supervised approach.

Post-class Feedback

After completing rotations, students joined a debriefing as well as a question-and-answer session. Feedback on the subject Jigsaw Method was collected via an online Google Forms comprising quantitative items (5-point Likert scale on organisation, materials, timing, and clinical applicability) and qualitative short-answer reflections. Quantitative data were analysed descriptively, and qualitative responses were thematically analysed. The quantitative survey items were adapted from established faculty evaluation forms and reviewed by two medical educationists for face and content validity. A pilot with non-participant students prompted minor wording changes. This year-long study included four Jigsaw sessions in the Family Medicine clerkship, each with ~16 fourth-year students.

RESULTS

A total of four practical Jigsaw classes were conducted, and feedback was gained from 54 of the total students.

Demographic Overview

Table 1 captures the demographic profile of the participants (n = 54), predominantly female and representing diverse ethnic backgrounds, with a significant proportion from the Malay group.

Table 1: Demographics of the participants (n = 54)

Variable	n (%)
Sex	
Male	15 (27.8)
Female	39 (72.2)
Race	
Malay	41 (75.9)
Indian	9 (16.7)
Chinese	4 (7.4)

Quantitative Feedback

Table 2 summarises the quantitative feedback, showing strong consensus among students on the usefulness, structure, relevance, and clarity of the sessions. However, a nuanced perspective emerges, with minor disagreement about time allocation and perceived applicability in clinical practice.

Table 2: Students' responses about the technical aspects of the practical Jigsaw classroom (n = 54)

Items	n (%)				
	Strongly agree	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
The content of the session was useful and interesting	48 (88.9)	6 (11.1)	0 (0.0)	0 (0.0)	0 (0.0)
The session was structured and well organised	47 (87.0)	6 (11.1)	1 (1.9)	0 (0.0)	0 (0.0)
The topics were relevant	51 (94.4)	3 (5.6)	0 (0.0)	0 (0.0)	0 (0.0)
The delivery of the contents during the sessions was clear	49 (90.7)	4 (7.4)	1 (1.9)	0 (0.0)	0 (0.0)
Rating of items	**Excellent**	**Very good**	**Good**	**Fair**	**Poor**
Materials	45 (83.3)	8 (14.8)	1 (1.9)	0 (0.0)	0 (0.0)
Time adequacy	47 (87.0)	0 (0.0)	0 (0.0)	7 (13.0)	0 (0.0)
Applicable in clinical practice	50 (92.6)	2 (3.7)	0 (0.0)	2 (3.7)	0 (0.0)
Overall rating	45 (83.3)	8 (14.8)	1 (1.9)	0 (0.0)	0 (0.0)

Qualitative Feedback

The qualitative component adopted a phenomenological design, with students submitting reflections after the surface anatomy Jigsaw session. Feedback was analysed to explore perceptions of clinical examination learning using the Jigsaw Method. Transcripts were imported into ATLAS. ti (version 9.0) and thematically analysed independently by two researchers (YIAB, NIY) following Braun and Clarke's six-phase framework (18), illustrated by Byrne (19) and guided by Qureshi et al. (20). An inductive, reflexive thematic approach allowed codes and categories to emerge from the data. Each researcher developed an initial coding framework, which was compared and refined for consistency. Expert triangulation was achieved through discussion of discrepancies, with a third researcher (NMH) consulted for consensus. In line with Braun and Clarke's guidance, statistical measures of inter-rater reliability were not calculated, as they are incongruent with reflexive TA. (21). Rigour was ensured through transparency, reflexivity, and consensus-building.

To ensure trustworthiness, the study addressed credibility, transferability, dependability, and confirmability (22). Credibility was ensured by accurately reflecting participants' experiences (23), while detailed contextual descriptions supported transferability (24). Dependability was maintained by documenting the research process for reproducibility (23), and confirmability was ensured by grounding findings in participants' responses rather than researcher bias (24). Thematic analysis produced two themes, derived from 57 codes, 21 concepts, and 12 categories.

Thematic Analysis Results

The examination of the subjective feedback from the participating students revealed two primary themes: (a) Attributes of effective clinical examination teaching; and (b) Benefits of effective clinical examination teaching to students.

Theme 1: Attributes of effective clinical examination teaching

Several subthemes emerged consistently in students' responses, providing insights into the key attributes of effective clinical examination teaching.

Teacher as a learning facilitator

Students frequently highlighted the lecturer's supportive role, appreciating clear guidance and encouragement during sessions. "The lecturer is very supportive and informative" [Student-14] and "The neonatal examination was guided thoroughly" [Student-08] reflect the facilitator's key role in enhancing learning.

Adequate hands-on clinical practice

Opportunities for hands-on practice were viewed as essential for developing clinical skills. Despite the demand for more clinical examination timed stations, students emphasised, "Adequate chance to practice physical examination" [Student-02], and "All of us manage to practice every physical examination, despite there are four different sub-sessions" [Student-02].

Peer teaching to facilitate learning

Students found peer teaching enriching and effective, as it reinforced their understanding through collaboration. Comments like "Teaching our friends strengthens knowledge" [Student-10], "We learn by teaching others" [Student-04], and "Friend-taught knowledge helped me prepare" [Student-51] highlight its benefits.

The use of appropriate tools to facilitate learning

Students found that using simulation tools, like manikins, significantly enhanced their learning experience. Employing appropriate tools in a simulated environment leads to effective learning. A student explained, "Well-organised, practice on a manikin with findings, and have discussions among group members according to the questions given. Have a manikin with pathology that we can learn from" [Student-31].

Interactive learning environment

Learning in small, familiar groups creates a safe and conducive environment, both academically and psychologically. Small-group settings helped create a focused, comfortable learning atmosphere, fostering better engagement. A student remarked, "We divide into smaller groups, hence making the session less crowded, and we can have a better understanding" [Student-23].

Reflective learning

Students valued reflection as a means to identify and improve weaknesses. Despite the intensive session, they appreciated guided feedback and discussions. One noted, "The doctor told us what we did right and wrong, asked questions, and had discussions with members and lecturers" [Student-16].

Theme 2: Benefits of effective clinical examination teaching to students

Five recurring subthemes emerged in the students' responses, providing insights into the advantages of effective clinical examination teaching.

Promote understanding of knowledge

Students found both lecturer- and peer-led activities valuable for enhancing clinical skills. They noted, "The teaching session helps us improve our skill examination" [Student-41] and "Students can brush up clinical skills under lecturer guidance" [Student-35].

Promote active engagement in learning

Structured simulation activities promoted active participation, encouraging students to ask questions and engage with peers and lecturers. One shared, "The teaching session allowed us to practice, ask questions, and discuss with members and lecturers" [Student-17].

Provide a positive clinical learning experience

Students appreciated the well-organised session and use of simulation tools, which enhanced their clinical learning. One noted, "The teaching session was well organised... we practised on the manikin and discussed with group members" [Student-03].

Improve clinical skills competency

Students found the Jigsaw classroom effective for improving clinical and soft skills in a small-group setting. They valued supervised practice, noting, "Students are allowed to brush up their clinical skills under the guidance of the lecturer" [Student-35].

Motivate self-directed learning

A well-structured environment enabled students to practice clinical examinations independently, promoting self-directed learning with adequate support. One noted, "All of us manage to practice every physical examination despite there being four different sub-sessions" [Student-02].

Student feedback highlights key elements of effective clinical teaching: supportive facilitation, hands-on practice, peer learning, appropriate tools, interactive settings, and reflection. The integration of guided simulation, peer-led activities, and structured debriefing created a meaningful, skill-enhancing learning experience.

Table 3: Themes and subthemes in students' reflection (n = 54)

Themes	Subthemes	Representative quote(s)
Theme 1: Attributes of effective clinical examination teaching	Teacher as learning facilitator	"Discussion with the lecturers is good and precise. We have enough time to discuss, and the lecturer is very supportive and informative" [Student-14].
	Use peer to facilitate learning	"Teamwork, group discussion, strengthen our knowledge by teaching our friends" [Student-10]
	Use of appropriate tool to facilitate learning	"Well-organised, practice on a mannequin with findings and have discussions among group members according to the questions given. Have a mannequin with pathology that we can learn from" [Student-31].
	Adequate hands-on clinical practice	"Adequate chance to practice physical examination" [Student-02].
	Interactive learning environment	"We divide into smaller groups, hence making the session less crowded and we can have better understanding" [Student-23].
	Reflective learning	"When the doctor taught, took turns going to each group and told us what we did right and wrong in practice, asking questions, having discussions with members and lecturers" [Student-16].
Theme 2: The benefits of effective clinical examination teaching to students	Promote active engagement in learning	"The teaching session allowed us to practice, ask questions, and discuss with members and lecturers" [Student-17].
	Promote understanding of knowledge	"The teaching session helps us to improve our skill examination" [Student-41].
	Improve clinical skills competency	"Students are allowed to brush up their clinical skills under the guidance of the lecturer" [Student-35].
	Provide positive clinical learning experience	"The teaching session was well organised. Students are able to practice on the mannequin with findings and discuss with group members according to the questions given" [Student-03].
	Motivate self-directed learning	"All of us manage to practice every physical examination despite there are four different sub-sessions" [Student-02].

DISCUSSION

This study examined the integration of simulation-based and real-patient teaching during primary care clerkships. Simulation provides a controlled, low-pressure environment for skill development (25), whereas real-patient encounters offer authentic and complex clinical exposure. A balanced combination supports comprehensive learning, as emphasised by Saiboon et al. (5) and Watson et al. (25), who highlighted the complementary role of simulation in medical and nursing education.

Several factors influence learning in simulated clinical teaching, including scenario quality (26), student engagement (27), peer interaction (28), and lecturer guidance (5). Student feedback in this study provides useful insights for refining simulation-based clinical examination teaching. Participants received technical aspects such as materials, timing, and practicality positively, while qualitative responses highlighted elements of effective teaching practice. Although feedback was highly positive, these findings require careful interpretation. High satisfaction is often reported in well-facilitated sessions and may reflect appreciation of lecturer support as much as the Jigsaw structure itself. Moreover, as surveys were conducted immediately post-session, responses may have been affected by social desirability bias, which anonymity could mitigate but not eliminate.

Students highlighted peer teaching and supportive lecturers as central to effective clinical teaching. Peer teaching promotes interaction and participation (29), while lecturer facilitation is critical for skill acquisition (30,31). Access to appropriate materials, tools, and manikins further strengthens clinical knowledge and reasoning (3). The Jigsaw Method reinforces these elements by fostering skill execution and self-reflection, consistent with Kolb's experiential learning theory, which describes learning as a cycle of experience, reflection, conceptualisation, and experimentation (32). However, this study assessed students' perceptions rather than objective measures of competence. Although students valued the supportive simulated environment as preparation, perceived skill gains should not be assumed to reflect actual performance.

The effectiveness of learning facilitation in the Jigsaw classroom depends on adopting a student-centred approach, which encourages active participation and deeper learning engagement (33,34). Small group settings promote active involvement and support effective knowledge and skill acquisition (27). Team-based strategies, where students teach peers and demonstrate clinical skills, further enhance engagement and confidence, fostering self-regulated learning and meaningful participation (34,35). As medical school enrolment increases, peer-to-peer teaching has become a valuable approach in clinical education (36). Small group discussions support interactive learning (27), while the Jigsaw format promotes collaboration, expert-led discussions, and reflective engagement.

While overall feedback was positive, some students reported unequal participation and limited lecturer support during early Jigsaw sessions, which is a common challenge in collaborative learning (36). To address this, content was divided into smaller segments to reduce cognitive load and improve focus, for example, by separating neonatal examinations from anthropometric measurements (37). Future sessions will incorporate rotating leadership roles, structured peer feedback, and more active lecturer facilitation to promote balanced participation. These strategies, supported by educational research, aim to enhance engagement, accountability, and inclusivity, though this study assessed their effects only through student perceptions (34,38). Role bias and social desirability may also influence peer-led sessions, but these risks were minimised through lecturer supervision, standardised checklists, and anonymous feedback.

Students also expressed concerns about limited time for hands-on practice, which may have limited opportunities for deeper engagement or skill consolidation. Prior research suggests that differences in cognitive load across simulation activities, influenced by pacing and session structure, can affect learner experience and outcomes (39). While our study did not examine this relationship in detail, future research should explore how session duration and pacing interact with learner profiles to optimise engagement and learning in the Jigsaw model.

The Jigsaw method promotes peer teaching, engagement, and reflection, but differs from other student-centred approaches such as problem-based learning (PBL). Whereas PBL relies on open-ended case discussions, Jigsaw provides a structured format that assigns content responsibility to students, strengthening accountability and mastery. Comparative studies indicate that both methods enhance teamwork, but Jigsaw offers more focused content coverage and peer explanation (40). A crossover study found that while both SDL and Jigsaw improved knowledge, Jigsaw produced greater engagement, retention, and overall learning experience (41). It is particularly well-suited for procedural skills requiring structured peer interaction and hands-on practice.

Positive perceptions of peer teaching and collaborative learning support broader curriculum integration. Effective student-centred clinical teaching requires active facilitation by both educators and peers (42). Hence, educators need to design structured frameworks that promote organised, student-centred learning (33). The success of such approaches depends on applying educational theory and incorporating diverse resources, tools, and multimodal strategies (31).

Although this study was conducted in a single institution, cultural, institutional, and logistical factors may affect replication elsewhere. Variations in class size, faculty-to-student ratios, and access to simulation resources could present unique challenges in adopting the Jigsaw model (26). Curriculum designers should also consider cultural expectations around peer-led teaching, which may influence acceptance and effectiveness (43). For implementation, key strategies include: (a) training peer facilitators with standardised checklists and structured materials; (b) allocating sufficient time for hands-on practice to prevent rushed skill acquisition; and (c) using longitudinal evaluations such as follow-up surveys or objective assessments to assess sustainability. These measures can support the scalability and adaptability of the Jigsaw method across diverse educational contexts. Future research should therefore examine longitudinal student outcomes, structured faculty development, and multi-site trials to evaluate broader applicability.

Strengths and Limitations

This study offers several strengths. It is among the first to apply the Subject Jigsaw method in simulation-based clinical examination teaching, contributing feasibility evidence for structured peer-led learning in primary care clerkships. The mixed methods design enriched interpretation by combining quantitative survey findings with qualitative reflections. Standardised instructional materials, video resources, and checklists supported consistency, while lecturer supervision provided real-time feedback to maintain accuracy in peer-led facilitation. Rigour in the qualitative component was enhanced through independent coding, analyst triangulation, consensus-building, and reflexivity, improving the trustworthiness of findings.

The study's practical strengths include its conduct within an authentic undergraduate curriculum, demonstrating feasibility in a busy clerkship setting. The model aligns with national standards for small-group clinical teaching set by the Malaysian Medical Council and Malaysian Qualifications Agency, highlighting its relevance for medical education in resource-limited contexts. The use of widely available resources, such as Bloomsbury Educational's Clinical Examination Videos and Stanford Medicine 25, further illustrates scalability by supporting standardised pre-class preparation.

Several limitations should also be acknowledged. Conducted at a single site, the findings may not generalise to other institutions, disciplines, or cultural contexts. The absence of randomisation and a comparator group limit causal inference. Immediate post-session feedback does not capture long-term retention or transfer of skills into patient care, and future research should include longitudinal follow-up in authentic clinical environments. Potential role bias and social desirability bias may have influenced student responses, as expert students facilitated sessions while peers provided feedback. Mitigation strategies included standardised checklists, structured materials, lecturer supervision, and anonymous online feedback, but such influences cannot be entirely excluded. Similarly, thematic analysis, while rigorous, remains subject to researcher interpretation despite measures to enhance reflexivity and transparency.

Finally, students noted time constraints and limited facilitator support in some sessions. Given that pacing affects cognitive load and engagement, session duration and structure warrant further exploration. The Jigsaw approach also requires careful planning, resource investment, and faculty development in simulation design, which may challenge wider adoption.

Despite these constraints, the study provides valuable preliminary evidence on the feasibility and acceptability of integrating the Subject Jigsaw method with simulation in clinical skills training. These findings can guide curriculum design, inform faculty development, and support future longitudinal and multi-institutional studies to evaluate scalability and sustainability.

CONCLUSION

This study demonstrated the value of integrating simulation-based teaching with the Subject Jigsaw method in clinical examination training. The aim was not to replace traditional bedside teaching with real patients but to complement it with a structured, collaborative approach. By combining simulation with peer-led learning, the intervention enhanced students perceived engagement, accountability, and clinical readiness. These findings support the inclusion of structured peer-led simulation within clerkships to enrich, rather than substitute, conventional teaching methods. Future directions should include longitudinal evaluation of learning outcomes, faculty development to strengthen peer-led approaches, and multi-institutional studies to assess scalability and sustainability.

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ETHICAL APPROVAL

Ethics approval was obtained from the UniSZA Human Research Ethics Committee (UniSZA/UHREC/2023/573), and informed consent was secured.

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