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CLINICAL ARTICLE

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Implementation and educational impact of the step ladder system: A structured clinical competency framework for obstetrics and gynecology

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Abstract

Objectives: While competency-based medical education (CBME) has become globally accepted, especially in postgraduate training, its structured implementation in undergraduate obstetrics and gynecology (OBGYN) education remains limited. The Step Ladder System, developed at Tottori University, addresses this gap through a three-tiered competency framework across obstetrics, gynecology, and general practice. This system was further enhanced with a mobile application to streamline assessments and facilitate real-time feedback.

Methods: This study evaluated the implementation of the Step Ladder System by comparing stepwise competency achievement among 26 final-year medical students and 19 first-year residents during a 4-week OBGYN rotation in 2023. Competency completion was tracked using the mobile app, which allowed instructors to log performance and provide immediate feedback.

Results: After the 4-week rotation, both students and residents demonstrated high completion rates for Step 1 tasks (75%–90%) across all domains, while Step 3 completion remained consistently low (<30%), reflecting the advanced complexity of those competencies. In some areas, students outperformed residents at Step 1, indicating strong preparation in basic OBGYN skills. Residents generally outperformed students at Steps 2 and 3, particularly in Obstetrics. The app-based system increased the frequency of real-time feedback and facilitated broader instructor engagement, with all 15 faculty members participating in evaluations.

Conclusions: The Step Ladder System, enhanced by a mobile application, effectively supports basic competency acquisition and feedback in undergraduate and early postgraduate OBGYN training. The persistently low achievement of advanced competencies highlights the need for extended clinical exposure or supplemental simulation training. This structured framework may serve as a scalable model for other specialties pursuing competency-based education.

KEYWORDS
clinical clerkship, competency-based education, digital learning platform, medical education, obstetrics and gynecology

1 | INTRODUCTION

The evolution of medical education has underscored the necessity for structured, participatory clinical clerkships, enabling students to integrate into medical teams and engage actively in diagnostic and procedural learning. Globally, competency-based medical education (CBME) has emerged as a central paradigm, emphasizing the progressive development of clinical skills through structured training.[1] CBME is an outcomes-based approach where learners advance by demonstrating specific competencies rather than merely completing a set duration of training.[2] This model ensures that training is focused on the acquisition of observable skills and behaviors necessary for safe, independent clinical practice.

Several internationally recognized CBME frameworks have been developed to support this approach. The ACGME Milestones project in the USA defines developmental stages from novice to expert, establishing benchmarks that residents must meet before advancing to more complex tasks.[3] This ensures that residents acquire foundational skills before progressing. Similarly, Entrustable Professional Activities emphasize the gradual acquisition of practical competencies, promoting the concept of entrustment in clinical tasks, where supervisors assess whether learners can independently perform specific clinical activities.[4,5] CanMEDS, originating from Canada, also supports the notion of progressive competency acquisition through its defined roles and performance milestones, such as Medical Expert, Communicator, and Collaborator, which guide the development of well-rounded physicians.[6] These frameworks illustrate a global consensus on the importance of structured, competency-based approaches to medical education.

In Japan, the revision of the Medical Practitioners Act in April 2021 permitted medical students, designated as Student Doctors, to perform most medical procedures under supervision (excluding prescribing), expanding their clinical responsibilities.[7] This regulatory shift created an imperative for robust educational systems to ensure patient safety and effective skills development. However, traditional obstetrics & gynecology (OBGYN) rotations often lacked standardization in training content, as teaching was heavily influenced by the instructor's specialty (perinatology, oncology, reproductive medicine, etc.) and enthusiasm. This variability led to gaps in students' exposure to essential skills and placed a disproportionate burden on highly motivated instructors. There was a clear need for a standardized, transparent framework to guide clinical education in OBGYN.

To address these challenges, the Step Ladder System was developed at Tottori University as a structured competency framework specifically designed for undergraduate and junior resident training in OBGYN.[8,9] The tiered structure draws on the principles of CBME and entrustable professional activities, ensuring that fundamental tasks are achieved before advancing to more complex competencies. By clearly delineating expectations, the Step Ladder System promotes consistent educational quality regardless of instructor variability and fosters a sense of progression for learners.

To further enhance the standardization of evaluations, the Step Ladder was digitized via a smartphone application (Figure 1). The app facilitates real-time assessments, tracks progress, and enhances communication between students and instructors. Key features include QR (Quick Response) code scanning for evaluation, a five-point rating scale for performance, instant feedback messaging, and a dashboard for program directors to monitor overall progress and instructor participation. The digital platform is expected to increase feedback frequency and decrease the administrative load on instructors by simplifying the evaluation workflow.

This study introduces the structure of the Step Ladder System and examines its educational impact by analyzing achievement data collected through the mobile application. We compare the performance of final-year medical students and junior residents within the OBGYN rotation under this system. We hypothesize that the Step Ladder System, especially with digital integration, improves the attainment of competencies in a time-limited rotation and provides insights into areas where curriculum time or teaching methods may need adjustment.

2 | MATERIALS AND METHODS

This study was a non-randomized, observational pilot evaluation of the Step Ladder System as implemented in an OBGYN clerkship.

2.1 | System description

The Step Ladder System comprises three progressive steps that students must climb, with clearly defined objectives at each step. Progression from Step 1 to Step 2 to Step 3 requires demonstration of all required competencies of the preceding step (as verified by instructor sign-offs). The competencies are grouped into three modules—Obstetrics, Gynecology, and General Practice—reflecting the breadth of OBGYN. For example, in obstetrics, Step 1 focuses on observing deliveries and understanding basic labor management, Step 2 on performing parts of procedures (like cervical examinations or ultrasound measurements) under supervision, and Step 3 on independently managing more complex tasks (like handling obstetric emergencies) under indirect supervision. Students were provided with a checklist booklet listing all Step 1–3 items at the start of the rotation, and were instructed that completing all items of a step was required to advance to the next step. Instructors (attending

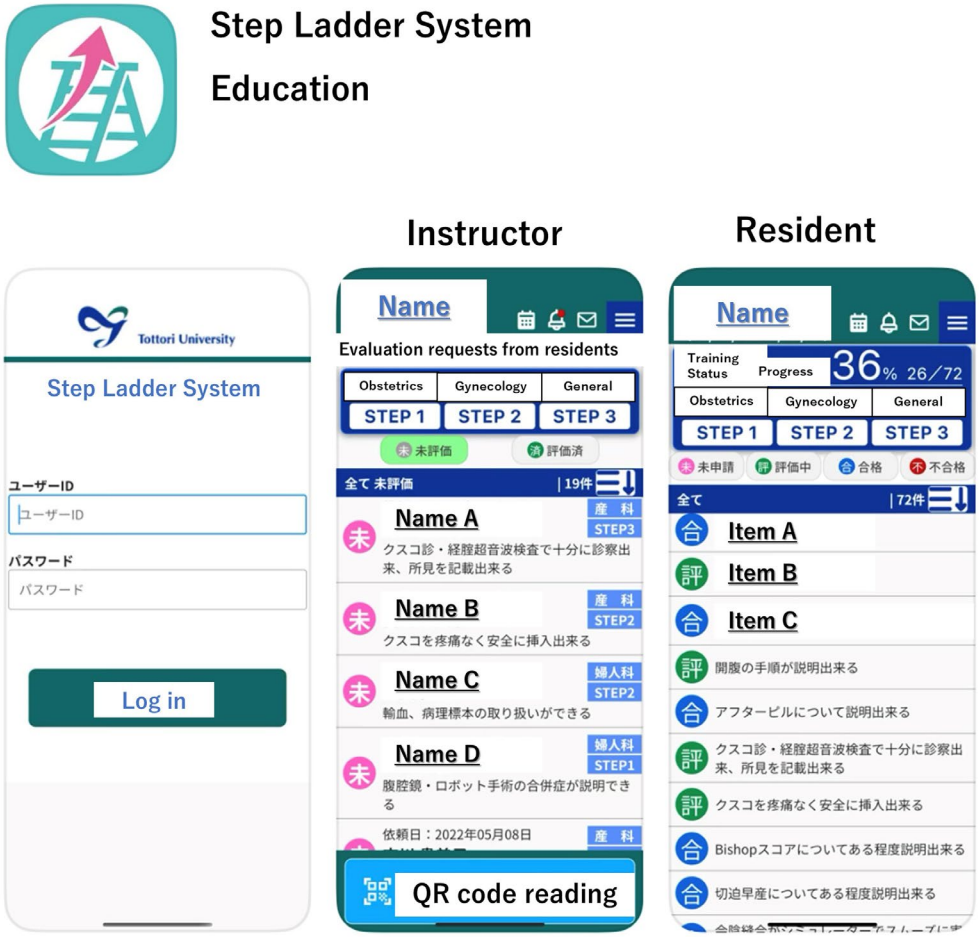

FIGURE 1 Step Ladder System application interface. Screenshots of the Step Ladder System mobile application used in clinical education. The left panel displays the login screen. The middle panel shows the instructor interface, where supervisors can view pending evaluation requests by category (Obstetrics, Gynecology, General) and by step (1–3). The right panel displays the resident interface, which allows learners to track their current achievement rate and view detailed competency items. This real-time feedback mechanism enhances learner self-awareness and encourages proactive engagement with clinical tasks.

physicians or senior residents approved as evaluators) would sign off on an item when they judged a student had sufficiently achieved it. This paper-based checklist formed the basis of the historical comparison cohort.

2.2 | Digital implementation

To modernize this process, we developed a smartphone application for the Step Ladder System. The app digitalized the checklist: instructors could scan a QR code associated with a specific item on a student's phone to log a completion, immediately rate the student's performance on a 5-point scale, and provide feedback comments. Push notifications alerted students of new feedback. The app also recorded which instructor evaluated each item, allowing program directors to quantify instructor engagement (number of items signed off by each instructor). A centralized dashboard aggregated each student's progress and each instructor's contributions, aiming to incentivize both learner engagement and instructor participation. This digital platform was piloted and then implemented for all OBGYN rotations, starting in 2023.

2.3 | Participants and data collection

From April to December 2023, a total of 26 final-year medical students (6th-year students) and 19 first-year residents in OBGYN participated in the Step Ladder curriculum during their 4-week OBGYN rotation. All participants used the mobile application for tracking Step Ladder achievements. For each participant, the app recorded which step items were completed (signed off) by the end of the rotation. These data were exported for analysis. We calculated achievement rates for each Step (1, 2, 3) in each domain module for both student and resident groups. Achievement rate was defined as the percentage of checklist items in a given category that were accomplished (signed off) by a learner or group. For example, if a domain had 10 Step 2 items and a student completed 6, their Step 2 achievement for that domain would be 60%. We then aggregated

these rates across all students and all residents to get group-level performance by domain and step.

For a historical comparison, we also analyzed archived paper checklists from a cohort of 30 final-year students in 2021 (before the app implementation). These students underwent the same OBGYN rotation with the Step Ladder checklist in paper form. We calculated overall Step 1, Step 2, and Step 3 achievement for this cohort (overall and by gender) by determining what proportion of the checklist items for each step were completed by the end of the rotation. In this cohort, 12 were male and 18 female, allowing a gender-based comparison. This retrospective analysis was used to assess whether the transition to a digital platform and the inclusion of residents in the program had any notable impact on outcomes.

2.4 | Outcome measures

The primary outcomes were the Step achievement rates for students and residents, by Step (1–3) and module (Obstetrics, Gynecology, General). Secondary observations included differences between student and resident performance, differences by gender in the student cohort, and qualitative effects on instructor workload and feedback frequency, as perceived anecdotally and through the app's tracking of evaluations. No formal survey of instructors was conducted, but the number of signed-off items per instructor was extracted from the app data as an objective indicator of teaching burden distribution.

Descriptive statistics (percentages) are used to report achievement rates. Given the descriptive nature of the study and the small sample sizes, no hypothesis-driven comparative statistical tests were performed; the focus was on educational significance and identification of trends requiring curricular attention. This study was part of an educational program evaluation and was exempt from institutional review board approval, as all data were collected as part of routine educational assessment and were anonymized for analysis. All participants were included as a convenience sample based on their enrollment during the study period. Given the small sample size, gender-based comparisons are exploratory in nature and not powered for statistical inference.

3 | RESULTS

After the 4-week rotation, student performance was strongest at Step 1 and progressively declined at Steps 2 and 3. Tables 1–3 and Figure 2 present the achievement rates for final-year students and junior residents across the three modules (Obstetrics, Gynecology, and General Practice). Both groups demonstrated high completion of Step 1 items in all modules (75%–90%), while Step 3 achievements remained consistently low (<30%).

Students generally performed as well as, or in some cases better than, junior residents in Step 1 across all modules. For example, in Gynecology Step 1, students achieved 86.4% of items compared with 77.5% for residents, whereas in General Practice Step 1, students achieved 74.6% versus 66.8% for residents. This suggests that final-year medical students were adequately prepared in basic OBGYN skills upon graduation.

However, at Step 2, residents outperformed students in most modules, particularly in Obstetrics (66.3% for residents vs. 54.6% for students). By Step 3, residents showed higher achievement in Obstetrics and Gynecology, but absolute completion rates were low for both groups (students 17%–20%, residents 15%–27%). This reflects the complexity of advanced skills, which often require extended training beyond a short rotation.

The introduction of the app-based system enhanced feedback frequency. Each student had a median of 45 items evaluated (out of 81 total), with real-time comments from instructors. The app's tracking of instructor contributions also showed that all 15 attending physicians participated in evaluations, promoting more even distribution of teaching responsibilities.

Overall, these results demonstrate that the Step Ladder System effectively supports competency attainment in basic skills (Step 1) for both students and residents, while highlighting the challenges of achieving advanced skills (Step 3) within a limited training period.

4 | DISCUSSION

This study demonstrates the implementation of a structured, competency-based framework in an OBGYN clinical rotation and its reinforcement through digital technology. The findings carry several implications.

By the end of the clerkship, final-year students performed comparably to junior residents on many Step 1 tasks, indicating that a structured undergraduate curriculum with clear objectives can raise student competencies to near postgraduate levels. However, both students and residents struggled to complete Step 3 tasks within the short rotation, suggesting that additional training time or high-fidelity simulation may be required for these advanced competencies; indeed, a targeted mastery-learning intervention in another study enabled medical students to achieve proficiency in complex procedures before graduation.[10]

Our implementation aligns with the global shift toward competency-based medical education frameworks such as the ACGME Milestones and Core Entrustable Professional Activities, which set clear developmental benchmarks for medical trainees.[11,12] Furthermore, replacing the paper checklist with a mobile app in our program is consistent with reports that QR code-based logging systems enhance feedback frequency and transparency while enabling continuous tracking of trainee competencies.[13,14]

Implementing a structured assessment system like the Step Ladder not only affects learners, but also has meaningful implications for faculty teaching practices. Our digital platform recorded each teaching interaction, which made instructor contributions visible and quantifiable. Anecdotally, we observed that faculty were eager to engage once they saw their feedback count and

TABLE 1 Stepwise competency achievement rates in obstetrics.

Obstetrics module	Students (%)	Residents (%)
Step 1		
Can explain the third stage of labor	96.2	89.5
Can explain the Bishop score	96.2	89.5
Can explain the Apgar score	100.0	89.5
Can explain CTG (NST)	92.3	89.5
Can explain threatened preterm labor	96.2	84.2
Can perform perineal suturing smoothly on a simulator	53.8	52.6
Can tie surgical knots using a simulator	84.6	84.2
Has observed a vaginal delivery	80.8	89.5
Has observed vaginal examination during labor	65.4	84.2
Has observed a cesarean section	100.0	100.0
Total	86.5	85.3
Step 2		
Can insert Cusco speculum painlessly and safely	88.5	84.2
Can measure cervical length via transvaginal ultrasound	46.2	63.2
Can visualize fetus and placenta via transabdominal ultrasound	57.7	78.9
Can perform vaginal exam during labor and explain findings	15.4	57.9
Can explain NST classification and abnormalities	73.1	68.4
Can explain the risks of imaging during pregnancy	65.4	63.2
Can explain basic information about drug use in pregnancy	57.7	63.2
Can perform a single suture for perineal repair	0.0	31.6
Has observed a cesarean section (with surgical scrubbing)	92.3	89.5
Can examine a newborn	50.0	63.2
Total	54.6	66.3
Step 3		
Can document findings from speculum and transvaginal ultrasound	15.4	57.9
Can measure fetal size via transabdominal ultrasound	42.3	68.4
Can explain labor progression from vaginal findings	3.8	26.3
Can appropriately respond to NST abnormalities	3.8	5.3
Can explain the steps of elective cesarean section	34.6	31.6
Can explain management of obstetric hemorrhage	23.1	15.8
Can comprehensively explain obstetric complications (e.g. HDP, GDM)	7.7	15.8
Can explain indications for operative vaginal delivery	26.9	15.8
Total	19.7	29.6

Note: Achievement rates (%) for Step 1, Step 2, and Step 3 competencies in the Obstetrics module among final-year medical students and first-year residents. Students showed strong performance in Step 1, while residents outperformed students in Steps 2 and 3.

Abbreviations: CTG, cardiotocograph; GDM, gestational diabetes mellitus; HDP, hypertensive disorders of pregnancy; NST, non-stress test.

impact. This experience is borne out by recent research on faculty development within CBME frameworks. Teaching self-efficacy—instructors' confidence in their ability to educate effectively—can be enhanced through regular participation in structured teaching and assessment activities. A recent study in Japan examined a "clinical ladder" program (a concept similar to our Step Ladder) integrated into a pediatric clerkship and measured attending physicians' teaching self-efficacy before and after the program.[15] The results showed that faculty who invested sufficient time in supervising and assessing students (at least 2 h per week over at least 3 months) had a significant improvement in their teaching self-efficacy scores. In contrast, those with minimal engagement saw no change. These findings support the idea that structured assessment tools can serve as faculty development instruments: by using the checklist and app to observe and give feedback, instructors are effectively practicing the skills of coaching and assessment regularly, thereby boosting their own confidence and competence as educators. Improved teaching self-efficacy is not just a feel-good outcome—it has been linked to higher teaching quality, better educator well-being, and even improved student

TABLE 2 Stepwise competency achievement rates in gynecology.

Gynecology	Students (%)	Residents (%)
Step 1		
Can explain causes and treatments of cervical, endometrial, and ovarian cancer	73.1	42.1
Can interpret MRI images showing uterine or ovarian abnormalities	57.7	78.9
Can explain pelvic anatomy (uterine support structures and vessels)	96.2	73.7
Can perform skin suturing using a simulator	80.8	84.2
Can hold a needle with laparoscopic simulator	96.2	84.2
Has observed laparotomy (or viewed surgical video with supervisor)	96.2	100.0
Has observed abdominal closure (or viewed surgical video with supervisor)	88.5	100.0
Has attended preoperative explanation to a patient	92.3	94.7
Has attended treatment plan explanation to a patient	96.2	78.9
Can explain cervical cancer and HPV vaccination	92.3	68.4
Can explain complications of laparoscopic and robotic surgery	80.8	47.4
Total	86.4	77.5
Step 2		
Can explain treatment plan for patients admitted for diagnostic purposes	15.4	31.6
Can explain types and side effects of chemotherapy	46.2	36.8
Can explain gynecologic cancer staging (with textbook if needed)	65.4	47.4
Can handle blood transfusion and pathology specimens	50.0	78.9
Can perform dermal suturing	65.4	84.2
Can explain the procedure of laparotomy	73.1	52.6
Can explain the procedure of abdominal closure	73.1	52.6
Can tie sutures (manual or instrument knot tying)	73.1	89.5
Can operate uterine manipulator	38.5	57.9
Can suture and ligate using laparoscopic simulator	76.9	63.2
Can remove intra-abdominal or subcutaneous drains	42.3	63.2
Can insert urinary bladder balloon	61.5	84.2
Has participated in robotic surgery	30.8	42.1
Total	54.7	62.7
Step 3		
Can perform laparotomy under supervision	7.7	21.1
Can perform abdominal closure under supervision	11.5	31.6
Can insert uterine manipulator	23.1	31.6
Can set up for laparoscopic surgery	0.0	0.0
Can briefly handle laparoscopic camera	46.2	68.4
Can manipulate forceps in laparoscopic surgery	7.7	15.8
Can insert/extract robotic surgical instruments	19.2	15.8
Can observe inside bladder using flexible cystoscopy	0.0	10.5
Can exchange CV port puncture needle	15.4	31.6
Total	14.5	25.1

Note: Achievement rates (%) for Step 1, Step 2, and Step 3 competencies in the Gynecology module among final-year medical students and first-year residents. Students had higher completion rates than residents at Step 1, whereas residents generally exceeded students at higher steps.

Abbreviation: CV, central venous; IVF, in vitro fertilization; MRI, magnetic resonance imaging.

achievement. In our implementation, the app's transparency (which allowed program leadership to see how often each faculty member provided sign-offs) may have also incentivized instructors to be more involved, knowing their efforts were recognized. This kind of system can gradually influence teaching behavior, encouraging instructors to adopt a more consistent, competency-focused approach in their daily teaching. Additionally, having a clear checklist of skills likely helped to standardize what instructors

TABLE 3 Stepwise competency achievement rates in general practice.

General practice	Students (%)	Residents (%)
Step 1		
Observed outpatient clinics (antenatal, chemotherapy, etc.)	100.0	73.7
Observed Cusco speculum exam and transvaginal ultrasound	100.0	94.7
Observed fertilized ova under microscope (including egg retrieval)	57.7	52.6
Observed embryo transfer and IVF procedures	23.1	21.1
Can explain the menstrual cycle	92.3	63.2
Can explain how to calculate expected date of delivery	100.0	78.9
Can explain types of oral contraceptives	80.8	57.9
Can explain ectopic pregnancy	96.2	68.4
Can list differential diagnoses for abdominal pain	84.6	47.4
Can take a preliminary history	38.5	100.0
Can secure intravenous access (even with peer simulation)	50.0	78.9
Total	74.8	67.0
Step 2		
Can insert Cusco speculum painlessly and safely	92.3	84.2
Can visualize uterus on transvaginal ultrasound	53.8	57.9
Can perform vaginal irrigation and exam under anesthesia	53.8	73.7
Can perform cervical cytology (under supervision)	23.1	47.4
Can list causes of genital bleeding	73.1	42.1
Can determine expected date of delivery	38.5	21.1
Can explain methods of menstrual control	69.2	42.1
Can explain emergency contraception (morning-after-pill)	80.8	52.6
Can explain management of menopausal symptoms	76.9	42.1
Can diagnose uterine prolapse	30.8	31.6
Can present cases at conference	46.2	68.4
Total	58.0	51.2
Step 3		
Can visualize ovaries via transvaginal ultrasound	34.6	36.8
Can perform endometrial cytology (under supervision)	7.7	10.5
Can hold probe during egg retrieval under ultrasound	0.0	5.3
Can make differential diagnosis and treatment plan for abdominal pain	19.2	5.3
Can assess surgical indications in emergencies	3.8	5.3
Can explain diagnostics and treatment for menopausal symptoms	46.2	26.3
Can explain abnormalities of reproductive organs	3.8	15.8
Has read entire manga series *Kounodori*	23.1	15.8
Total	17.3	15.1

Note: Achievement rates (%) for Step 1, Step 2, and Step 3 competencies in the General Practice module. Both students and residents achieved high Step 1 completion rates, but performance dropped significantly at Step 3 in both groups.

Abbreviation: IVF, in vitro fertilization.

teach—faculty reported that the Step Ladder checklist gave them a concrete teaching agenda, ensuring that they covered core skills with each student. This mirrors findings from other institutions that structured frameworks provide clarity for teachers, reduce variability in bedside teaching, and help less experienced faculty by outlining expected teaching points. In summary, our study adds to a growing body of evidence that CBME tools are mutually beneficial: learners get regular, structured feedback, and instructors develop stronger teaching practices and self-efficacy through their engagement with these tools.

Finally, the Step Ladder concept is now being expanded beyond OBGYN. Other departments (such as Surgery, Urology, Pediatrics) at our institution have shown interest and some have begun to develop their own ladder-style competency checklists. We anticipate that

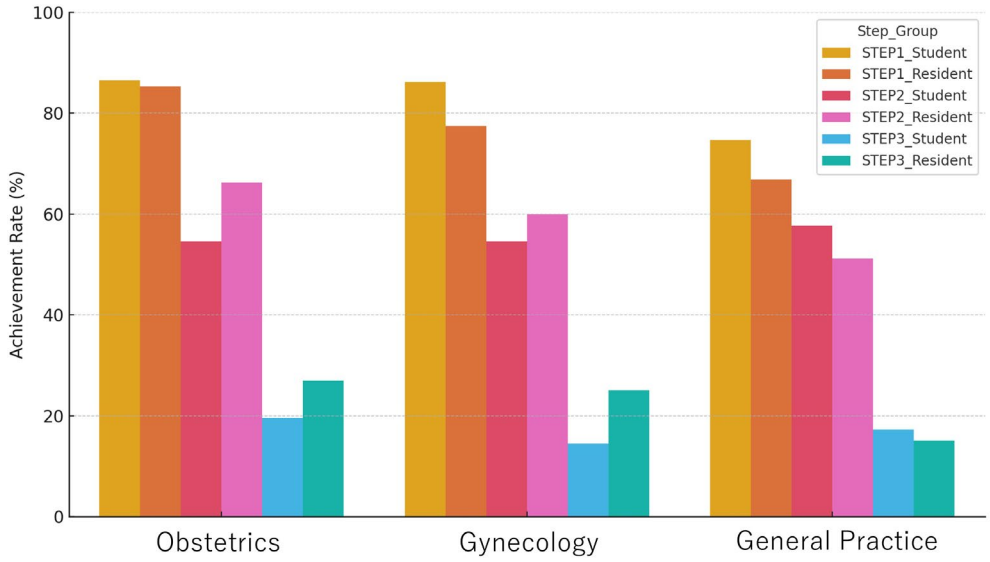

FIGURE 2 Stepwise competency achievement rates by clinical domain and training level. Bar chart comparing the percentage of checklist items completed at Step 1, Step2, and Step 3 across three domains—Obstetrics, Gynecology, and General Practice—between final-year medical students (blue bars) and first-year OBGYN residents (orange bars). Students demonstrated comparable or higher achievement in Step 1 across all domains, while residents showed greater completion rates in Step 2 and Step 3, particularly in Obstetrics and Gynecology. Step 3 achievement remained low for both groups in all domains.

each specialty will customize the steps and items to fit their unique needs, but the core principle of a clear, stepwise progression could be universally applicable. If widely adopted, this approach could contribute to a more standardized clinical education nationwide, while still allowing flexibility for each discipline's essential skills.

In terms of strengths, this program's novelty lies in its structured, stepwise training framework combined with digital integration, which to our knowledge has not been previously reported anywhere. However, the study is limited by the small number of participants and the early stage of implementation in other departments, which currently restricts the generalizability of our findings.

In conclusion, the Step Ladder System represents an innovative approach to structuring clinical education in OBGYN. Through tiered competencies and digital integration, it enhances student learning, improves feedback, and facilitates continuity from undergraduate to postgraduate training. The near-universal completion of Step 1 tasks and substantial completion of Step 2 tasks by medical students indicate that a well-structured clerkship can ensure competence in fundamental skills. The limited attainment of Step 3 highlights the need for curriculum adjustments (longer rotations or simulation supplements) to support higher-level competencies. The integration of a mobile app proved to be a valuable adjunct, promoting real-time assessment and broad instructor engagement without altering the core outcomes of the program.

This structured framework, validated by our two-cohort comparison, offers a blueprint for competency-based education that can be adapted across specialties. By clearly delineating what a student should learn, and providing the tools to track it, the Step Ladder System empowers learners to take ownership of their training and helps instructors to more effectively coach the next generation of physicians. As medical education continues to evolve toward competency-based models, our experience with the Step Ladder System may serve as a model for others aiming to achieve the dual goals of educational rigor and practical feasibility in clinical training.

AUTHOR CONTRIBUTIONS

HK was involved in study design and data interpretation, and was a major contributor in writing the manuscript. All authors were involved in data analysis. All authors critically revised the report, commented on drafts of the manuscript, and approved the final report.

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CONFLICT OF INTEREST STATEMENT

The authors have no conflicts of interest.

DATA AVAILABILITY STATEMENT

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

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