

Educational Management Model for Enhancing Medical Professional Competence in Forensic and Medicolegal Education through Artificial Wound Simulation

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ARTICLE INFO

Article history:

Received: April 28, 2026; Received in revised form: May 17, 2026; Accepted: May 29, 2026;

Available online: June 01, 2026;

ABSTRACT

This article examines the management of competency improvement for participants in a medical professional education program in forensic and medicolegal sciences. The central problem is the gap between expected forensic-medical competence and the limited learning conditions experienced during a short clinical rotation, particularly the scarcity of real forensic cases that can be observed and practiced directly by learners. The study used a qualitative case-study approach based on in-depth interviews, observation, and documentation. The analysis was organized through the educational management functions of planning, organizing, actuating, and controlling (POAC), and was integrated with competency-based medical education, simulation-based learning, and continuous quality improvement. The findings show that competency improvement requires careful planning of competency needs, an integrated curriculum, structured resources, active implementation through lectures, case discussions, laboratory practice, artificial wound simulation, and repeated writing exercises for *Visum et Repertum*. Evaluation through formative feedback, summative assessment, and simulation-based Objective Structured Clinical Examination (OSCE) indicated improvement in descriptive, analytical, documentary, confidence, and collaborative competencies. The article proposes an educational management model that integrates POAC with artificial wound simulation as an innovation to address limited rotation time and real-case scarcity. The model strengthens technical competence, reflective learning, medicolegal reasoning, and quality assurance in forensic medical education.

Keywords: artificial wound simulation, competency improvement, educational management, forensic medicine, medicolegal education, POAC, *Visum et Repertum*.

INTRODUCTION

Medical education has moved from a content-centered orientation toward competency-based medical education, in which learners are expected not only to understand scientific knowledge but also to demonstrate professional performance in authentic or near-authentic situations. In forensic and medicolegal education, this shift is particularly important because the competence of future physicians influences not only clinical decision-making but also the quality of legal evidence, victim protection, and the administration of justice. A physician who prepares a *Visum et Repertum* must be able to describe injuries accurately, interpret mechanisms of injury, document findings systematically, and communicate medical facts in language that can be understood by legal stakeholders. These tasks require a combination of clinical knowledge, observation skills, analytical reasoning, ethical sensitivity, and legal awareness.

The study setting demonstrates a common challenge in medical professional education: the rotation period in forensic medicine is short, while the availability of real forensic cases is unpredictable and limited. In a two-week rotation, learners may not encounter sufficient variation of wounds, case contexts, and medicolegal problems. This creates a gap between the curriculum's expected competencies and the actual opportunities for practice. The problem is not merely pedagogical; it is managerial. If the learning process is not planned, organized, implemented, and controlled systematically, students may complete the rotation without sufficient confidence in describing wounds, classifying injury mechanisms, and preparing a *Visum et Repertum*.

Artificial wound simulation offers a strategic response to this limitation. Simulation enables repeated exposure to wound types such as incised wounds, lacerations, abrasions, contusions, puncture wounds, and complex injuries. It allows learners to practice in a safe environment, receive immediate feedback, revise descriptions, and build confidence before facing real cases. However, simulation is not automatically effective. Its success depends on educational management: clear competency mapping, curriculum integration, resource allocation, instructor preparation, standard rubrics, reflective discussion, and continuous evaluation. Thus, the article positions artificial wound simulation not as a stand-alone teaching tool but as part of a comprehensive educational management model.

The article aims to analyze how competency improvement in forensic and medicolegal education can be managed through the POAC framework and how artificial wound simulation can be integrated into planning, implementation, evaluation, and model development. The argument is that the competency gap in forensic education should be addressed by a management model that combines structured curriculum design, multidisciplinary organization, experiential learning, formative and summative assessment, and a culture of continuous quality improvement. This perspective contributes to educational management by showing that clinical competence can be strengthened when learning innovation is embedded in a managerial system rather than treated as an isolated classroom technique.

THEORETICAL FRAMEWORK

The theoretical foundation of this article is built on educational management, competency-based medical education, simulation-based learning, and quality assurance. Educational management refers to the systematic process of planning, organizing, actuating, and controlling educational resources to achieve learning goals effectively and efficiently. Robbins and Coulter (2021) define management as a process of coordinating work activities so they are completed efficiently and effectively with and through other people. In education, these functions shape how

curriculum, instructors, facilities, learners, assessment instruments, and institutional policies are aligned to produce measurable learning outcomes. The POAC framework is therefore useful for analyzing forensic medical education because it connects the administrative structure of a program with the pedagogical experience of learners.

Planning is the first function and functions as the intellectual foundation of the program. In competency-based education, planning should begin with a needs assessment that identifies the gap between current student ability and the expected professional standard. The planning process must translate broad standards into operational learning outcomes, learning activities, and measurable indicators. Outcome-based education and entrustable professional activities provide a useful orientation because they require the curriculum to focus on what learners can actually perform under supervision or independently (Frank & Jabbour, 2016; ten Cate & Hennis, 2024). In forensic education, this means that students should not only memorize classifications of injuries but also demonstrate competence in observing, describing, reasoning, and documenting findings.

Organizing refers to arranging human resources, learning facilities, schedules, and roles so that learning activities can run smoothly. Forensic and medicolegal education requires collaboration among lecturers, clinical instructors, laboratory staff, simulated-patient or moulage actors, and legal or medicolegal resource persons. Organizing also includes the preparation of artificial wound materials, laboratory space, learning modules, and assessment rubrics. Without clear organization, simulation activities may become fragmented and fail to support the intended competencies.

Actuating concerns the implementation of learning. It includes the educator's role in motivating students, facilitating case discussion, guiding laboratory practice, supervising simulation, and encouraging reflection. This function is closely related to experiential learning, which states that learning occurs through concrete experience, reflective observation, conceptual understanding, and active experimentation (Kolb, 1984). Simulation-based learning is also aligned with constructivist assumptions because learners actively construct understanding by interacting with realistic clinical problems. In forensic education, artificial wounds provide concrete experience that bridges theory and practice.

Controlling refers to monitoring and evaluation. It is not limited to final grading but includes formative feedback, correction of student work, use of standardized rubrics, reflective portfolios, and summative assessment such as OSCE. Kirkpatrick and Kirkpatrick (2016) explain that training evaluation should examine reaction, learning, behavior, and results. In this article, evaluation is understood as a mechanism for continuous improvement: it identifies competency achievements, remaining gaps, and program revisions.

Three institutional citations strengthen the educational management perspective. Tambingon et al. (2023) emphasize that educational leadership contributes to learning quality through coordination, coaching, and the development of a quality culture. This supports the argument that competency improvement requires leadership that can integrate curriculum, instructors, and learning resources. Naharia (2023) underlines that knowledge development and educational systems require a systematic and integrated approach to support sustainable human resource quality. This is relevant because forensic competence cannot be improved through sporadic learning activities; it requires an integrated system. Umbase (2023) states that quality culture in higher education should be built through quality assurance and continuous evaluation, which reinforces the need to place formative and summative assessment at the center of the competency improvement model. These perspectives show that the management of forensic medical education must be systematic, integrated, quality-oriented, and continuously improved.

Literature Review and Analytical Perspective

Educational management in health professions education is increasingly expected to respond to the complexity of clinical learning. Unlike conventional classroom education, clinical learning takes place in dynamic environments where patient safety, service demands, ethical standards, and professional accountability intersect. Forensic and medicolegal education has an additional layer of complexity because the learning outputs are connected not only to clinical service but also to legal processes. The quality of a medical statement can affect how a case is interpreted in court, how victims obtain justice, and how institutions maintain public trust. Therefore, educational management in this field must be designed as a system of academic accountability.

A competency-based perspective requires educators to identify the visible indicators of competence. In the context of forensic injury examination, competence is visible when a learner can observe a wound systematically, use anatomical terminology accurately, measure and document the wound precisely, interpret the possible mechanism without exaggeration, and write conclusions in a way that is medically objective and legally meaningful. These indicators are not produced instantly by lectures. They require repeated practice, guided correction, and exposure to varied examples. Because real cases are limited and ethically sensitive, artificial wound simulation becomes a practical way to provide repeated exposure without violating ethical principles.

The literature on simulation-based learning emphasizes safety, repetition, feedback, and realism. Safety means that learners can make mistakes without harming patients or damaging legal evidence. Repetition means that learners can practice the same competency several times until performance improves. Feedback means that instructors can immediately correct errors in observation, terminology, interpretation, and report writing. Realism means that the learning situation should resemble actual professional conditions sufficiently to stimulate serious engagement. In forensic education, realism does not always require sophisticated technology; even low-cost moulage can be valuable if the learning scenario, assessment rubric, and feedback process are well designed.

The management challenge lies in transforming simulation into a structured learning system. If artificial wounds are used only as visual aids, their contribution remains limited. They become educationally powerful when they are embedded in a sequence of activities: pre-briefing, observation, description, group discussion, individual report writing, debriefing, correction, and reassessment. This sequence reflects the principles of experiential learning and deliberate practice. Deliberate practice requires that learners work on specific tasks, receive immediate feedback, repeat the task, and progressively handle more complex cases. The findings of the study show that students improved when simulation was not treated as a single event but as part of a cycle.

Quality assurance is another essential aspect. A program that aims to improve competence must be able to show whether learning outcomes are actually achieved. This requires valid assessment instruments. In forensic and medicolegal education, assessment should include written tests for conceptual knowledge, direct observation for practical behavior, OSCE stations for standardized performance, and portfolio assessment for longitudinal development. The use of several assessment methods improves fairness because no single instrument can capture all dimensions of competence. It also helps the program identify whether weaknesses arise from knowledge, practice, communication, or documentation.

The theoretical contribution of this article is the integration of educational management and simulation-based medical education. The POAC framework gives the model managerial clarity, while competency-based and simulation-based approaches give it pedagogical depth. Planning ensures that the simulation responds to defined competency gaps. Organizing ensures that people, materials, time, and space are arranged properly. Actuating ensures that the learning cycle is

delivered actively and reflectively. Controlling ensures that learning outcomes are measured and that results are used for improvement. Thus, the model is not merely a teaching innovation but a management framework for sustaining professional competence.

This analytical perspective is especially relevant for institutions with limited resources. Many medical education settings cannot rely on a continuous flow of real forensic cases, nor can they immediately provide advanced simulation technology. The model therefore encourages contextual innovation. Artificial wounds can be produced with available materials, learning modules can be developed gradually, and assessment rubrics can be standardized before more advanced technology is introduced. In this sense, the model is scalable. It can begin with simple resources and evolve toward digital integration, augmented reality, or inter-institutional collaboration.

Another important analytical point concerns the relationship between hard skills and soft skills. Forensic education is often associated with technical competence, but the findings show that confidence, collaboration, ethical awareness, and communication are also essential. Students who can describe wounds technically but cannot explain findings clearly may still struggle in real medicolegal practice. Similarly, students who know legal requirements but lack confidence may hesitate when producing a report. Artificial wound simulation creates a safe context for developing these soft skills because learners discuss, present, defend, and revise their observations. This process builds professional identity as well as technical competence.

The study also indicates that leadership plays a decisive role. Educational leadership is needed to coordinate instructors, allocate resources, standardize assessment, and maintain motivation. Without leadership, simulation activities may depend on individual enthusiasm and become inconsistent. Tambingon et al. (2023) highlight the role of leadership in improving learning quality through coordination and quality culture. This article extends that idea by showing how leadership can support a specialized clinical education model. Leaders should ensure that simulation is recognized in the curriculum, included in workload planning, and supported through continuous faculty development.

Finally, the literature suggests that sustainability is a key issue. A model may be effective during one implementation cycle but fail to continue if it is not institutionalized. Sustainability requires written guidelines, trained instructors, budget planning, evaluation data, and policy support. It also requires continuous improvement based on student feedback and performance results. Umbase (2023) emphasizes quality assurance and quality culture in higher education, while Naharia (2023) emphasizes systematic and integrated knowledge development. These perspectives underline that the proposed model should not be seen as a temporary learning activity, but as a sustainable educational management system.

METHOD

This article is based on a qualitative case-study design. The approach was selected because the research problem concerns a complex educational process that cannot be fully captured through numerical measurement alone. The study sought to understand how competency improvement is planned, organized, implemented, and evaluated in a specific forensic and medicolegal learning context. Qualitative inquiry enabled the exploration of experiences, practices, obstacles, and strategies from the perspectives of lecturers, instructors, students, and institutional actors.

Data were collected through in-depth interviews, observation, and documentation. Interviews explored perceptions of competency needs, learning difficulties, planning processes, implementation strategies, simulation experiences, evaluation methods, and suggestions for

improvement. Observation focused on learning activities such as theory sessions, laboratory practice, case discussions, artificial wound simulation, and student exercises in writing *Visum et Repertum*. Documentation included curriculum materials, learning schedules, competency rubrics, educational resource records, photographs of learning activities, and summary tables of findings.

The informants consisted of lecturers and forensic instructors, medical professional education students, hospital or educational management representatives, and supporting actors involved in the forensic learning process. Data were analyzed through reduction, display, and conclusion drawing. The analysis was organized thematically according to four main research concerns: planning, implementation, evaluation, and model formulation. Data validity was strengthened through triangulation among interview findings, observations, and documentation. This triangulation was important because competency improvement is not only a matter of what informants say but also what is visible in learning practice and institutional documentation.

The article deliberately removes references to the original academic document and personal authorship in the body of the article. The writing is presented as an independent journal manuscript. It uses the findings and supporting documentation as empirical material and reorganizes them into an English-language journal format similar to a public administration or educational management article, with an abstract, theoretical framework, method, findings, discussion, conclusion, and references.

RESULTS AND DISCUSSION

The findings show that competency improvement in forensic and medicolegal education is shaped by four interrelated managerial dimensions: planning, implementation, evaluation, and model formulation. The first finding concerns planning. The program had identified the core competencies that students must master, particularly wound description, injury mechanism analysis, documentation, and *Visum et Repertum* writing. However, students entered the rotation with different levels of readiness. Some students understood basic concepts but struggled to use precise anatomical terminology. Others could recognize common wounds but were uncertain when asked to link morphology with mechanism. The most visible gap was between theoretical knowledge and practical ability. See table 1, and figure 1

Table 1. Informant structure used for triangulating findings

Category	Number	Informant Codes	Contribution to Data
Forensic lecturers and instructors	4	DIF-01 to DIF-04	Explained curriculum planning, supervision, simulation design, and assessment of competency.
Medical professional education students	6	MPP-01 to MPP-06	Provided learning experience, perceived difficulties, confidence development, and feedback on simulation.
Educational or institutional management actors	3	MRS-01 to MRS-03	Explained institutional support, resource allocation, scheduling, and policy implications.
Supporting professional actors	3	APK-01 to APK-03	Provided perspectives on medicolegal relevance, legal documentation, and practice context.

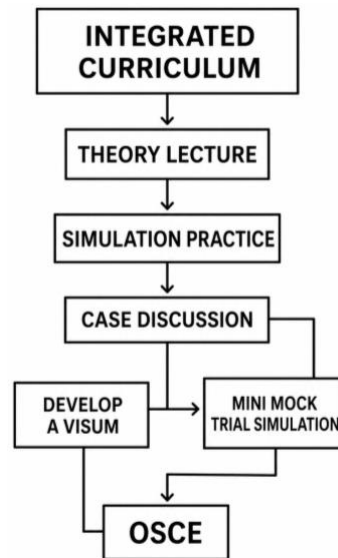


Figure 1. Integrated curriculum cycle for forensic and medicolegal learning.

Planning was also influenced by the short duration of the rotation. The available time required the program to prioritize essential competencies. An integrated curriculum was therefore developed around a cycle of theory, simulation, case discussion, writing exercise, and assessment. This design is consistent with outcome-based education because the curriculum was directed toward performance outcomes rather than the completion of isolated topics. The planned learning outputs included accurate wound description, correct interpretation of injury mechanism, systematic documentation, ethical awareness, and basic ability to prepare a Visum et Repertum.

Resource planning was another important finding. The program benefited from experienced and dedicated lecturers and instructors, but human resources were limited. Instructors had to divide their time between service responsibilities, teaching activities, and supervision. Physical resources were also limited. The laboratory environment could support practice, but simulation facilities were still modest, and artificial wounds were produced using available materials. Non-physical resources such as scheduling, rubrics, modules, and feedback systems were increasingly recognized as important components of the learning system. See table 2, and figure 2.

Table 2. Planning findings for competency improvement

Planning Aspect	Main Finding	Constraint	Improvement Strategy
Competency needs analysis	Students needed stronger ability in wound description, mechanism analysis, documentation, and medicolegal reasoning.	Gap between theory and practice; low confidence; inconsistent terminology.	Use focused simulation modules, structured descriptive rubrics, and repeated writing exercises.
Integrated curriculum	The curriculum used outcome-based learning with a cycle of theory, simulation, discussion, assessment, and feedback.	Two-week rotation and limited real forensic cases.	Prioritize core competencies and integrate artificial wound simulation in every thematic block.
Educational resources	Experienced lecturers and instructors were available, but their	Teaching load, service load, and limited laboratory equipment.	Create clear role distribution, develop simulation kits, and

Planning Aspect	Main Finding	Constraint	Improvement Strategy
Learning assessment plan	number and time were limited. OSCE, observation, and written report correction were considered appropriate.	Manual scoring and inconsistent rubrics.	involve trained supporting instructors. Standardize assessment rubrics and combine formative feedback with summative assessment.

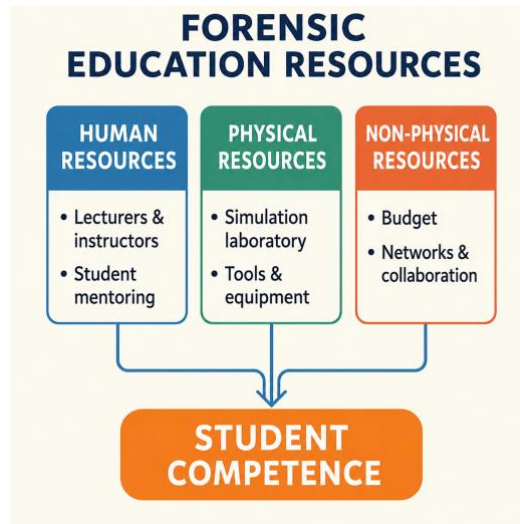


Figure 2. Educational resources supporting student competence.

The second finding concerns implementation. Learning activities began with short theoretical sessions that introduced core concepts: classification of injuries, medicolegal principles, terminology, and the structure of Visum et Repertum. These sessions were intentionally concise because the rotation time was limited. Students reported that theory became more understandable when it was linked to cases and visual examples. After the theory session, students moved into laboratory practice and artificial wound simulation. This was the most important bridge between abstract knowledge and applied competence. Students were asked to observe simulated wounds, describe location, size, direction, edges, base, and surrounding tissue, and infer possible mechanisms. See table 3, and figure 3.

Table 3. Implementation findings in the competency improvement process

Component	Main Activity	Learning Benefit	Remaining Challenge
Theory session	Short interactive lecture on wound classification, medicolegal principles, and Visum et Repertum structure.	Provides conceptual foundation and shared terminology.	Students can be overwhelmed by dense material in limited time.
Laboratory practice	Observation and hands-on practice using artificial wounds.	Strengthens visual recognition and technical description.	Facility quality and realism of wounds still require improvement.
Case discussion	Students present findings and compare interpretations.	Improves reasoning, peer learning, and reflective correction.	Participation is not always equal among students.

Component	Main Activity	Learning Benefit	Remaining Challenge
Writing exercise	Students draft Visum et Repertum based on simulated findings.	Improves documentary competence and legal clarity.	Some reports remain too medical and insufficiently clear for legal users.

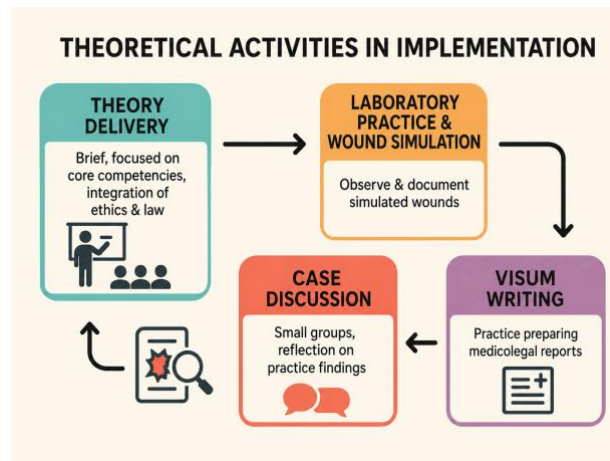


Figure 3. Theory, laboratory practice, case discussion, and report writing cycle.

Case discussion and reflection played a central role in consolidating learning. Students presented their observations and received feedback from lecturers and peers. Errors in terminology, incomplete descriptions, and unsupported conclusions were discussed openly. This process improved students' ability to reason, compare, and revise. The discussion also helped students understand that Visum et Repertum is not merely a medical report but a medicolegal document that must be clear, objective, and understandable for legal processes.

The third finding concerns evaluation. Evaluation showed improvement in descriptive, analytical, documentary, confidence, and collaborative competencies. Before simulation, students often wrote general descriptions such as "wound on the right arm." After repeated simulation and feedback, descriptions became more precise, such as by identifying anatomical region, type of wound, size, direction, edge characteristics, and depth. Analytical competence also improved because students became better able to connect wound morphology with blunt trauma, sharp trauma, or other mechanisms. Documentary competence improved through repeated practice in writing structured reports. Confidence increased because the simulation environment allowed students to practice without the fear of harming patients or being overwhelmed by real-case pressure. See figure 4.

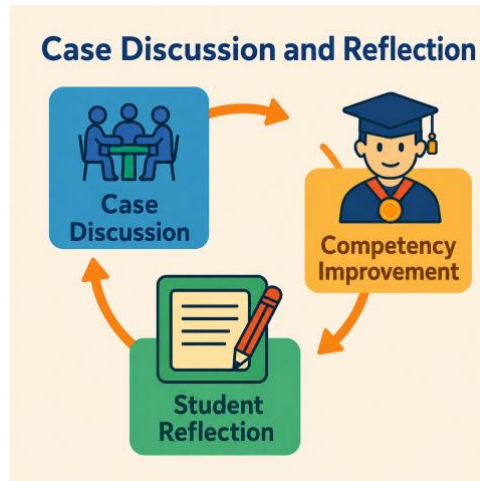


Figure 4. Case discussion and reflection as a bridge to competency improvement.

Nevertheless, several constraints remained. Some students still had difficulty distinguishing complex wounds, such as mixed patterns or lacerations with irregular morphology. The realism of artificial wounds needed improvement. The assessment system required more standardized rubrics, and the rotation time remained too short to ensure deep mastery. These constraints indicate that artificial wound simulation should be expanded and integrated with digital resources, portfolios, standardized OSCE stations, and continuous feedback. See figure 5.

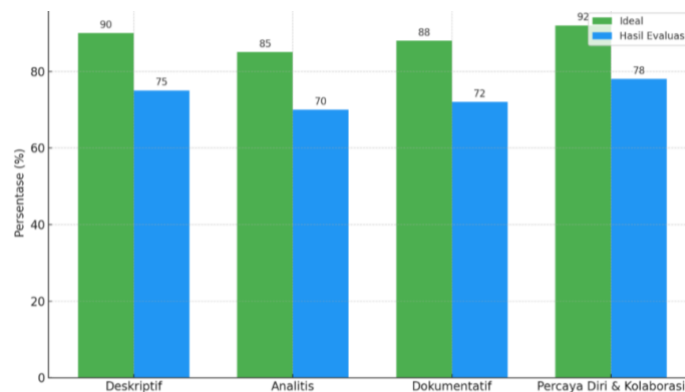


Figure 5. Comparison of ideal competence and evaluation results after learning activities.

The fourth finding concerns model formulation. The proposed model integrates POAC with artificial wound simulation. Planning includes needs assessment, curriculum integration, learning outcome design, and resource preparation. Organizing includes role distribution among lecturers, instructors, laboratory staff, and supporting actors. Actuating includes theory sessions, simulation, case discussion, writing practice, and reflective learning. Controlling includes formative feedback, OSCE, portfolio assessment, and continuous improvement. The model is designed to transform a short and case-limited rotation into a structured, competency-oriented learning experience. See figure 6.



Figure 6. SWOT analysis of forensic educational management and simulation-based learning.

The findings confirm that the improvement of forensic and medicolegal competence cannot be achieved only by adding learning materials. It must be managed as an integrated educational system. The POAC framework provides a useful structure because it highlights the managerial process behind competency development. Planning determines what competence should be achieved and how limited time can be used efficiently. Organizing aligns human resources, learning facilities, and roles. Actuating translates curriculum into learning experiences through theory, practice, simulation, and reflection. Controlling ensures that competency achievement is monitored, corrected, and improved.

The planning findings show that competency-based education requires precise mapping of learning needs. In forensic and medicolegal education, the gap is not only cognitive but also performative. Students may know definitions of wounds but fail to produce an accurate, legally useful description. This finding supports the argument of outcome-based education that learning should be designed backward from the expected performance. When the desired output is an independent, accurate *Visum et Repertum*, planning must include the micro-competencies needed to reach that output: observation, measurement, anatomical localization, wound-type identification, mechanism reasoning, documentation, and communication. See table 4.

Table 4. Evaluation results after artificial wound simulation

Competency Area	Observed Improvement	Evidence of Learning	Recommended Follow-Up
Descriptive skill	Students wrote more complete and systematic wound descriptions.	Use of anatomical location, size, shape, direction, edge, depth, and tissue condition became more precise.	Develop a checklist-based rubric and require repeated practice across wound types.
Analytical skill	Students were better able to relate morphology to sharp or blunt force mechanisms.	Case discussion encouraged comparison, justification, and correction of conclusions.	Add complex and mixed-case simulations to strengthen reasoning.

Competency Area	Observed Improvement	Evidence of Learning	Recommended Follow-Up
Documentary skill	Reports became more structured and closer to the required Visum et Repertum format.	Students practiced transforming observation into legally useful written statements.	Use templates, portfolio assessment, and lecturer feedback cycles.
Confidence and collaboration	Students became more willing to present findings and revise them after feedback.	Small-group simulation reduced anxiety and encouraged peer correction.	Ensure balanced participation and rotating presentation roles.

Artificial wound simulation strengthens planning because it offers a controllable learning resource. Real forensic cases are unpredictable, and ethical considerations limit direct student involvement. Simulation solves this problem by creating standardized exposure. Every student can observe similar wound types, practice repeatedly, and receive comparable feedback. This standardization is important for fairness in assessment and for ensuring that all students experience the essential range of forensic learning. It also aligns with the educational leadership perspective of Tambingon et al. (2023), which emphasizes the importance of coordination, coaching, and quality culture in improving learning quality.

The organizing findings demonstrate that human resources are central. Dedicated lecturers and instructors are a strength, but limited numbers and workload pressure create vulnerability. A simulation-based model requires more than subject knowledge; it requires instructors who can prepare artificial wounds, facilitate discussion, provide feedback, and assess performance consistently. Organizing must therefore include role clarity. Lecturers can focus on conceptual explanation, supervision, and summative evaluation; instructors can support practical exercises and peer teaching; laboratory staff can prepare materials and space; and external legal or medicolegal resource persons can enrich the legal relevance of learning. This collaborative organization reduces dependence on a single lecturer and makes the program more sustainable. See table 5.

Table 5. Proposed POAC-based model for forensic competency enhancement

POAC Function	Main Component	Key Activity	Output Indicator
Planning	Needs analysis, integrated curriculum, simulation module, assessment design.	Review competency standards, map student gaps, design artificial wound scenarios, plan OSCE rubrics.	Integrated curriculum, simulation modules, realistic schedule, measurable learning outcomes.
Organizing	Role distribution, resource preparation, interdisciplinary coordination.	Assign lecturers, instructors, laboratory support, legal resource persons, and feedback responsibilities.	Clear structure, effective coordination, prepared facilities, and shared responsibility.
Actuating	Theory, simulation, case discussion, report writing, reflection.	Deliver interactive sessions, conduct artificial wound practice, guide Visum writing, and facilitate reflection.	Active learning, improved performance, and stronger clinical-medicolegal reasoning.
Controlling	Formative feedback, OSCE, portfolio, quality assurance.	Assess performance, correct reports, evaluate	Reliable assessment, documented progress, continuous

POAC Function	Main Component	Key Activity	Output Indicator
		student progress, revise modules and rubrics.	improvement, and stronger quality culture.

The implementation findings show that students learn best when they move from theory to practice and then to reflection. A short lecture provides conceptual orientation, but the artificial wound simulation creates a concrete experience. Case discussion then transforms that experience into reasoning, and writing practice transforms reasoning into formal documentation. This sequence reflects experiential learning (Kolb, 1984). It also supports the view that medical education should be active, contextual, and competency-oriented. Students become not only receivers of information but participants who observe, interpret, explain, and revise their work.

The evaluation findings are particularly important. Improvement in descriptive competence indicates that students became more capable of converting visual observation into precise written language. Improvement in analytical competence indicates that they learned to connect wound morphology to possible mechanisms. Improvement in documentary competence indicates that they could organize findings into a medicolegal report. Improvement in confidence and collaboration indicates that simulation also contributes to affective and social competence, not only technical competence. This supports Kirkpatrick and Kirkpatrick's (2016) view that evaluation should examine multiple levels of training impact.

Nevertheless, the model still needs strengthening. First, the realism of artificial wounds should be improved through better materials, moulage training, and potentially digital or augmented reality support. Second, the curriculum should include more diverse and complex wound scenarios, including mixed injuries and unusual presentations. Third, assessment rubrics should be standardized so that feedback is consistent across instructors. Fourth, the two-week rotation should be supported by pre-rotation digital modules and post-rotation portfolio activities to extend learning beyond face-to-face time. Fifth, quality assurance should be institutionalized. Umbase (2023) emphasizes that quality culture in higher education depends on systematic quality assurance and continuous evaluation. This means that simulation activities must be reviewed regularly, not only delivered as routine practice.

The model also has policy implications. Institutions that experience limited forensic case exposure can adopt artificial wound simulation as a required curriculum component. However, adoption should be accompanied by management guidelines, instructor development, resource planning, and evaluation standards. Naharia (2023) argues that the development of knowledge and educational systems requires systematic and integrated approaches to support sustainable human resource quality. In this context, the artificial wound simulation model becomes a systematic intervention for professional human resource development in medical education. See table 6.

Table 6. Strategy for implementing the model

Strategic Dimension	Implementation Step	Success Indicator	Challenge and Solution
Curriculum integration	Place artificial wound simulation as a mandatory component of the forensic rotation.	At least 80% of students achieve accurate wound description and basic Visum writing competence.	Limited time can be addressed through pre-rotation digital modules.
Instructor development	Train lecturers and instructors in simulation facilitation, feedback,	Feedback becomes more consistent and student performance becomes easier to monitor.	Workload can be addressed by role-sharing and scheduled mentoring.

Strategic Dimension	Implementation Step	Success Indicator	Challenge and Solution
	and standardized scoring.		
Facility strengthening	Develop low-cost simulation kits and gradually improve materials for realism.	Students experience varied wound types and repeated practice opportunities.	Budget constraints can be addressed through phased procurement and local innovation.
Quality assurance	Use formative assessment, OSCE, portfolios, and periodic curriculum review.	Program improvement is evidence-based and continuous.	Administrative burden can be reduced through digital documentation.

The discussion also highlights the novelty of the model. Many simulation studies focus on teaching technique, but this article frames simulation within educational management. The novelty lies in integrating POAC, competency-based education, artificial wound simulation, and continuous quality assurance into one model. The model addresses both the learning problem and the management problem: limited cases, short rotation, uneven competence, constrained resources, and the need for standardized assessment. As a result, the proposed model can be adapted by other institutions that face similar constraints in forensic and medicolegal education.

Proposed Model

The proposed model can be described as a POAC-based forensic educational management model supported by artificial wound simulation. In the planning phase, the program begins with a competency needs assessment. The assessment identifies student limitations in descriptive, analytical, documentary, ethical, and confidence-related competencies. These needs are then translated into an integrated curriculum that prioritizes essential outcomes. The curriculum includes theoretical orientation, artificial wound simulation, case discussion, Visum et Repertum writing, and OSCE assessment. Planning also includes resource analysis, because the success of simulation depends on lecturers, instructors, laboratory facilities, and standardized materials.

In the organizing phase, the model requires clear distribution of roles. A program coordinator ensures that the curriculum, schedule, and assessment align with institutional standards. Lecturers provide theoretical input, supervise learning, and conduct summative assessment. Instructors facilitate practice and provide immediate feedback. Laboratory staff prepare artificial wounds and learning spaces. Supporting actors from legal or medicolegal contexts enrich the discussion of evidence and report usefulness. Organization should be flexible, collaborative, and technology-supported, because forensic education involves multiple domains and limited time.

In the actuating phase, learning is implemented through an integrated cycle. Students first receive concise theoretical learning. They then observe artificial wounds, practice description, and analyze possible mechanisms. Case discussion follows, allowing students to compare interpretations and correct mistakes. Writing practice translates observations into Visum et Repertum format. Reflection encourages students to connect learning with professional responsibility, patient rights, legal justice, and ethical communication. This cycle is repeated across several wound types to build mastery.

In the controlling phase, competency is assessed through formative feedback, rubrics, OSCE stations, and portfolio documentation. Formative assessment provides immediate correction. OSCE evaluates performance under standardized conditions. Portfolio assessment documents progress across cases. Program evaluation reviews student outcomes, instructor feedback, facility adequacy,

and curriculum relevance. The control function ensures that the model does not stop at implementation but continues to improve based on evidence. See figure 7

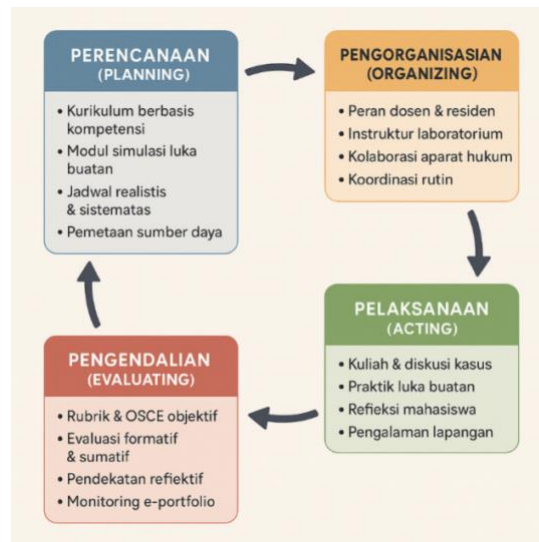


Figure 7. Integrated management model linking planning, organizing, actuating, and controlling.

The model has three major outputs. The first output is student competence: students become better able to describe wounds, analyze mechanisms, document findings, and prepare a medicolegal report. The second output is institutional quality: the program becomes more standardized, accountable, and adaptable despite limited real cases. The third output is social and legal relevance: future physicians become more prepared to contribute accurate medical evidence in legal processes. These outputs demonstrate that the model is not only a teaching strategy but a management innovation.

Practical Implications and Contribution

The practical implication of the model is that forensic and medicolegal education can be improved without waiting for ideal conditions. The availability of real cases will always be uncertain because forensic cases depend on events outside the control of educational institutions. If the curriculum depends only on real cases, the learning experience of each student cohort will be unequal. Some students may observe several relevant cases, while others may complete the rotation with almost no direct exposure. Artificial wound simulation reduces this inequality by ensuring minimum exposure for all learners. It creates a baseline experience that every student can receive regardless of case availability.

For curriculum managers, the model provides a concrete roadmap. The first step is to define the minimum competencies that must be achieved by the end of the rotation. The second step is to design simulation scenarios that represent these competencies. The third step is to prepare learning resources, including wound models, standardized descriptions, sample Visum et Repertum templates, and scoring rubrics. The fourth step is to implement the learning cycle with clear time allocation. The fifth step is to evaluate student performance and revise the model based on evidence. This roadmap helps transform innovation into a manageable academic program.

For lecturers and instructors, the model encourages a shift from information delivery to facilitation. In a traditional lecture, the lecturer controls the flow of knowledge and students tend to become passive recipients. In simulation-based learning, the lecturer becomes a facilitator of

experience, reflection, and correction. Students must observe, write, discuss, defend, and revise. This requires instructors to ask guiding questions rather than simply provide answers. For example, instead of telling students that a wound is caused by blunt force, the instructor can ask which morphological features support that conclusion and what alternative interpretations should be considered. Such questioning strengthens critical thinking.

For students, the model provides a safer pathway to competence. Forensic practice can be intimidating because errors in description and interpretation may have legal consequences. Simulation reduces anxiety by allowing students to practice before entering real medicolegal situations. Repeated simulation also helps students develop professional habits: observing systematically, avoiding assumptions, documenting objectively, and using clear language. These habits are essential because forensic documentation must be defensible, reproducible, and useful to non-medical readers.

For institutions, the model supports quality assurance. The use of standardized simulation cases and OSCE rubrics allows the program to compare performance across cohorts. When data show that students consistently struggle with a particular competency, the curriculum can be revised. For example, if many students fail to distinguish incised wounds from lacerations, additional simulation cases can be created. If students write reports that are too technical, communication exercises can be added. In this way, evaluation becomes a tool for program improvement rather than a final administrative requirement.

The model also contributes to interprofessional collaboration. Forensic and medicolegal practice is not isolated from legal institutions, police procedures, social protection, and victim services. Therefore, simulation scenarios can be expanded to include legal communication, testimony preparation, and ethical decision-making. Collaboration with legal practitioners or medicolegal experts can enrich learning by helping students understand how medical reports are used outside the hospital. This extension would make the model even more relevant for professional practice.

In terms of research contribution, the article shows that educational management can be used as an analytical lens for clinical education innovation. Many medical education studies focus on whether a method works, but fewer examine how the method should be managed so that it works consistently. This article argues that effectiveness depends on both pedagogy and management. Artificial wound simulation improves competence when it is planned, organized, implemented, and evaluated systematically. Without management, even a good method may become inconsistent; with management, a simple method can become powerful and sustainable.

The proposed model has limitations that should be acknowledged. The findings are based on a specific institutional context and may not represent all forensic education settings. The availability of instructors, facilities, and institutional support may differ across regions. The model also relies on qualitative interpretation, so future studies may use quantitative or mixed-method designs to measure the magnitude of competency improvement. For example, future research can compare OSCE scores before and after simulation, measure retention after several months, or compare cohorts taught through conventional methods and simulation-integrated methods.

Despite these limitations, the model has strong transferability. Institutions can adapt the model according to their resources. A low-resource institution can begin with basic artificial wound materials and simple rubrics. A better-resourced institution can add digital modules, high-fidelity moulage, video feedback, and augmented reality. The essential principle is not the sophistication of the tool but the integration of tool, curriculum, instruction, feedback, and quality assurance. This principle makes the model relevant for diverse educational contexts.

The broader implication is that medical professional education should not separate managerial thinking from pedagogical innovation. Competence is produced by systems. When the system is weak, students depend on chance exposure and individual effort. When the system is well managed, students receive structured opportunities to practice, reflect, and improve. The POAC-artificial wound simulation model therefore offers a systematic pathway for transforming limited educational conditions into meaningful professional preparation. It strengthens the role of educational management in supporting public health, legal justice, and professional accountability.

Recommendations for Implementation

Several recommendations can be derived from the model. First, the institution should formally integrate artificial wound simulation into the forensic and medicolegal rotation. Formal integration is important because a method that is not written into the curriculum can easily depend on the availability and enthusiasm of individual lecturers. Curriculum documents should specify the number of simulation sessions, the wound types to be covered, the competencies to be assessed, and the expected performance standard. This ensures continuity across student cohorts.

Second, the program should develop a standardized simulation module. The module should include learning objectives, brief theoretical background, scenario descriptions, photographs or diagrams of wound types, observation checklists, Visum et Repertum templates, and assessment rubrics. A standardized module makes it easier for instructors to provide consistent guidance and for students to understand expectations. It also supports self-directed learning because students can review the module before and after practice.

Third, faculty development should be prioritized. Lecturers and instructors need training not only in forensic content but also in simulation facilitation, feedback techniques, assessment design, and student-centered learning. The success of the model depends greatly on the quality of feedback. Feedback should be timely, specific, constructive, and linked to performance criteria. Instructors should avoid giving only general comments such as “good” or “wrong”; instead, they should explain which part of the description is accurate, which part is incomplete, and how it can be improved.

Fourth, assessment should be strengthened through rubrics and portfolios. A rubric helps standardize evaluation across instructors, while a portfolio documents student progress. Each student can collect several wound descriptions, analysis notes, corrected Visum drafts, and reflection summaries. The portfolio becomes evidence of learning development and can be used for formative mentoring. It also supports quality assurance because the program can review common weaknesses across portfolios.

Fifth, digital learning support should be gradually developed. Digital support does not need to begin with expensive technology. The institution can start with video demonstrations, online modules, sample annotated reports, and digital quizzes. Later, it can expand to virtual case libraries, augmented reality, or inter-institutional digital repositories. Digital resources are especially useful because they extend learning beyond the short rotation period. Students can prepare before attending face-to-face sessions and continue learning after the rotation ends.

Sixth, the program should establish a continuous improvement cycle. After each rotation, student performance data, instructor reflections, and student feedback should be reviewed. Weaknesses in cases, materials, scheduling, or assessment should be identified and corrected. This cycle reflects the controlling function of management and supports the development of a quality culture. It also ensures that the model remains responsive to changing educational needs and professional standards.

CONCLUSION

Competency improvement in forensic and medicolegal education requires a structured educational management model. The short duration of the clinical rotation and the scarcity of real forensic cases create a serious gap between expected competencies and learning opportunities. Artificial wound simulation can address this gap, but it must be integrated into a broader management system. The findings indicate that planning must begin with competency needs analysis, integrated curriculum design, and resource preparation. Implementation must combine theory, laboratory practice, simulation, case discussion, writing practice, and reflection. Evaluation must be formative, summative, standardized, and continuously improved. The proposed POAC-based model integrated with artificial wound simulation provides a practical and theoretical contribution. Practically, it helps educators manage limited rotation time and limited real-case exposure while still strengthening student competence. Theoretically, it expands educational management by showing how management functions can be combined with simulation-based learning, competency-based education, and quality assurance. The model supports improvement in descriptive, analytical, documentary, confidence, and collaborative competencies. It also encourages a quality culture through structured feedback, OSCE, portfolio assessment, and periodic curriculum review.

Future implementation should strengthen instructor training, simulation realism, digital learning support, standardized rubrics, and institutional quality assurance. The model can also be adapted for other clinical education contexts where real cases are limited but competence must still be achieved. In this way, educational management becomes a strategic instrument for improving professional competence, patient and victim protection, and the quality of medicolegal service.

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