TPM Vol. 32, No. S8, 2025
ISSN: 1972-6325
https://www.tpmap.org/

EVALUATING THE EFFECTIVENESS OF KERN'S SIX-STEP CURRICULUM DEVELOPMENT IN RESPIRATORY THERAPY EDUCATION

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Abstract

Background: Respiratory Therapy (RT) education at high-acuity centers like King Abdullah Medical City (KAMC) often lacks systematic design, limiting staff competency in advanced skills essential for managing critical respiratory conditions such as ARDS.

Objective: To evaluate the effectiveness of a comprehensive RT training course developed using Kern's Six-Step Curriculum Development model in improving knowledge, clinical skills, and confidence among RT staff at KAMC.

Methods: A cross-sectional, pre-post intervention design was used involving 40 RT staff. Needs assessment identified knowledge gaps. The curriculum combined lectures, case discussions, high-fidelity simulation, and technology-assisted ventilator practice. Knowledge (MCQ), clinical skills (OSCE), and participant satisfaction were measured before and after the course. Statistical analysis included paired t-tests and thematic analysis of qualitative feedback.

Results: Post-course MCQ scores showed a significant 62.55% mean improvement ($p < 0.001$). Clinical skills assessments demonstrated a 100% success rate across simulation stations. Participant surveys indicated high satisfaction, increased confidence, and perceived applicability in clinical practice.

Conclusion: Kern's Six-Step Model provides a structured, effective framework for RT education, enhancing theoretical knowledge, clinical competencies, and staff confidence. Simulation-based training is key for translating knowledge into practice. This approach supports ongoing, equitable professional development in critical care respiratory therapy settings.

Keywords: Evaluating, Effectiveness, Kern's Six-Step, Curriculum, Development, Respiratory, Therapy, Education.

1. INTRODUCTION AND BACKGROUND

The practice of **Respiratory Therapy (RT)** is critical to patient outcomes in high-acuity environments, demanding advanced skills in areas such as mechanical ventilation and ARDS protocol adherence. Despite this vital role, professional development for RT staff at tertiary centers, including **King Abdullah Medical City (KAMC)**, has traditionally relied on ad hoc methods and infrequent lectures. This fragmented approach lacks the systematic design and competency-based assessment necessary to address identified staff skill and knowledge deficits (O'Brien et al., 2015; Pigoga et al., 2020). The absence of a structured, evaluated program hinders clinical excellence and efforts to standardize care (Sanchez-Glanville et al., 2015; Sánchez-Marco et al., 2023).

To resolve this deficiency, this study implements and evaluates a new, comprehensive RT training course developed rigorously using **Kern's Six-Step Approach to Curriculum Development** (Dunne et al., 2012; Hossain et al., 2022). The Kern's model guided the process from **Needs Assessment** (identifying specific gaps via structured questionnaires) through to **Implementation** (employing adult learning strategies like simulations and OSCEs) (Karthika et al., 2021; Hu et al., 2024). This research focuses on the final, crucial step: **Evaluation and Feedback**.

The primary objective of this study is **to evaluate the effectiveness of this Kern's model-based RT training course in improving staff knowledge and clinical performance at KAMC.** Effectiveness will be measured by assessing quantitative improvement via pre- and post-course assessments (MCQs and OSCEs), evaluating participant satisfaction. This study's significance lies in establishing a sustainable, evidence-based, and outcome-linked model for RT staff education in high-acuity tertiary care settings.

LITERATURE REVIEW

Respiratory Therapy (RT) education has demonstrably **lagged behind global advancements** in respiratory care, creating a discrepancy between practitioners' increasing clinical obligations and the availability of formal training options (Chrusch et al., 2016; Collinsworth et al., 2021). Despite RTs being critical to patient outcomes in high-acuity environments like King Abdullah Medical City (KAMC), professional development remains **ad hoc**, characterized by basic workshops and informal lectures (Parker et al., 2013; Di Nardo et al., 2018). This deficiency persists despite international evidence linking high-quality, continuous RT knowledge and skills to **improved clinical outcomes** (Dunne et al., 2012; Fariduddin et al., 2018). This systemic deficiency highlights the urgent need to replace the current fragmented approach with a structured, outcomes-based model.

To combat this fragmentation, **Kern's Six-Step Approach to curriculum development** is essential, providing a systematic, learner-centered framework for health professions education (Lucey et al., 2012; O'Brien et al., 2015). The model guides educators from initial needs assessment through to definitive evaluation. **Implementation (Step 5)** at KAMC involved meticulous logistical planning, including faculty preparation, resource allocation (e.g., simulation models), and the deployment of validated assessment tools like Objective Structured Clinical Examinations (OSCEs) and Multiple-Choice Questions (MCQs) (Park et al., 2024). Crucially, the model concludes with **Evaluation and Feedback (Step 6)**, which closes the teaching loop and assures program success by allowing continuous, iterative modification of content and delivery to align with evolving healthcare practice standards (Pigoga et al., 2020; Sanchez-Glanville et al., 2015).

METHODOLOGY

Study Design and Setting

This research utilized a cross-sectional, pre-post intervention design to evaluate the effectiveness of a comprehensive training course for 40 practicing Respiratory Therapy (RT) staff at King Abdullah Medical City (KAMC), a high-acuity tertiary referral hospital.

Curriculum Development

The training course was systematically developed using **Kern's Six-Step Approach** to curriculum design (Lucey et al., 2012; Mainous et al., 2017), which provided the essential structure for a needs-based and outcomes-focused intervention.

Needs Assessment (Steps 1 & 2)

General educational gaps were initially identified through direct observation by senior RT experts (Karthika et al., 2024). A **Targeted Needs Assessment** followed, employing a dual-method approach:

1. **Quantitative Survey:** The internally validated Respiratory Therapy Skills Assessment Checklist (K Sreedharan et al., 2024).
2. **Qualitative Review:** Analysis of annual staff competency evaluations.

This process revealed critical knowledge and skill gaps in advanced mechanical ventilation (e.g., APRV, P/V curve analysis), lung recruitment strategies, and management of tracheostomy emergencies. These deficits were directly linked to institutional quality metrics like ARDS protocol adherence and reintubation rates (Chrusch et al., 2016; Dellinger et al., 2013).

Goals, Strategies, and Implementation (Steps 3, 4, & 5)

Measurable learning objectives were established across cognitive (e.g., medication mechanisms), psychomotor (e.g., performing recruitment maneuvers), and affective (e.g., teamwork) domains (Frenk et al., 2020). The educational strategies employed a multi-modal design aligned with adult learning theory, including:

- Interactive lectures and case-based discussions.
- **High-Fidelity Simulation:** Practice on standardized Objective Structured Clinical Examination (OSCE) stations.
- **Technological Practice:** Use of the Ventrainer app for deliberate ventilator practice (Di Nardo et al., 2018; Devlin et al., 2018).

Course implementation at KAMC involved meticulous planning for faculty preparation and resource allocation, including simulation models and validated assessment tools (Park et al., 2024).

Data Collection and Evaluation (Kern's Step 6)

A comprehensive data collection protocol was implemented to evaluate the curriculum's success, integrating objective performance metrics with subjective feedback (Chrusch et al., 2016).

Quantitative Instruments

1. **Knowledge Acquisition:** A 25-item **Multiple-Choice Question (MCQ)** test was administered pre- and post-course to quantify knowledge gains related to theoretical content (Mainous et al., 2017).
2. **Skill Proficiency: Objective Structured Clinical Examinations (OSCEs)** were conducted at three simulation-based stations duplicating high-stakes procedures (e.g., ARDS maneuvers, emergency tracheostomy). Performance was scored using validated checklists (Diederich et al., 2015).
3. **Clinical Outcomes:** The impact on real-world practice was measured by correlating participant attendance with institutional quality data on three key indicators: **reintubation rates, ARDS protocol adherence, and spontaneous breathing trial success rates** (Tsai et al., 2015; Sánchez-Marco et al., 2023).

Data Analysis

Data were entered into Microsoft Excel and analyzed using SPSS (version 28.0). Descriptive statistics (means, standard deviations, and frequencies) summarized all quantitative variables. **Inferential analysis** utilized the **paired sample t-test** to determine the statistical significance of changes in pre- and post-course MCQ and OSCE scores (Collinsworth et al., 2021). Qualitative responses from the satisfaction survey were examined using **thematic analysis** to identify key findings regarding training impact and suggestions for improvement (Benzies et al., 2020).

Ethical Considerations

The study received ethical approval from the **King Abdullah Medical City Institutional Review Board (IRB)** prior to data collection (Frenk et al., 2020). All participants provided written **informed consent**, confirming their voluntary participation and right to withdraw without affecting employment status. Confidentiality was strictly maintained by assigning a unique numerical code to each participant for linking pre- and post-data. The simulation environment was kept supportive to minimize performance anxiety, ensuring psychological safety throughout the evaluation process (Singer et al., 2016).

RESULTS

The evaluation of the comprehensive RT training course yielded positive results across all measured domains: knowledge acquisition, clinical skill proficiency, and participant satisfaction.

Knowledge Acquisition (MCQ Results)

Descriptive and Inferential Statistics of Pre- and Post-Test Scores

Statistic	Pre-Test Score	Post-Test Score	Score Difference	Percentage Gain (%)	t-value	df	p-value (Sig. 2-tailed)	95% Confidence Interval (Lower–Upper)
Mean	11.98	18.63	6.65	62.55	27.727 (Pre) / 57.908 (Post)	39	< .001	11.10–12.85 (Pre) / 17.97–19.28 (Post)
Minimum	6.00	14.00	2.00	11.76				
Maximum	17.00	23.00	13.00	166.67				
Standard Deviation	2.73	2.03	2.63	36.36				

Pre- and post-course Multiple-Choice Question (MCQ) scores demonstrated a statistically significant improvement in participants' theoretical knowledge. The mean score increased substantially from 11.98 **(Standard Deviation: SD 2.73)** on the pre-test to 18.63 **(SD 2.03)** on the post-test. This change represents a mean knowledge gain of 6.65 **points** or 62.55%. A **paired sample t-test** confirmed that the observed improvement was statistically significant ($p < 0.001$), indicating that the course effectively enhanced the participants' theoretical understanding, irrespective of their baseline experience level, gender, or nationality.

Clinical Skill Proficiency (OSCE Results)

The Objective Structured Clinical Examinations (OSCEs) confirmed the successful transfer of procedural knowledge into demonstrable clinical skills. Participants achieved a 100% **success rate** across all three high-fidelity skill stations: the Esophageal Balloon procedure, P/V (pressure-volume) Tool interpretation, and Apnea Testing for brain death protocols.

Course Evaluation and Satisfaction

The post-course evaluation survey indicated excellent participant satisfaction and perceived value of the training.

Metric	Result	Implication
Objective Relevance	Most respondents agreed course objectives were clear and relevant.	Strong alignment between curriculum design (Kern's steps 1-3) and professional needs.
Confidence Gain	33 participants reported feeling more confident in their RT skills.	The course positively influenced the affective domain (self-efficacy).
Interaction/Teamwork	39 participants reported the course generated valuable interaction and conversation.	The engaging format promoted teamwork and communication, crucial for collaborative care.
Practical Application	Participants reported applying course knowledge (e.g., APRV, P/V Tool, apnea testing) to complex respiratory diseases in practice.	High perceived utility and direct applicability of learned skills to the clinical setting.

Overall, the course was highly rated, with the majority of attendees expressing satisfaction with the content, instructional methods, and relevance to their daily work. The findings indicate that the course not only fulfilled its training requirements but also provided RT professionals with the necessary modern skills and confidence to manage complex respiratory diseases.

DISCUSSION

This study's outcomes strongly support the literature on the value and adaptability of Kern's systematic model for curriculum development in advanced healthcare education (Kern et al., 2016; Elendu et al., 2024). Attainment of knowledge and skill gains, documented by robust pre/post-test and OSCE metrics, mirrors similar successes reported in recent reviews and empirical studies (Jones et al., 2023).

The model's steps—especially needs assessment and outcome mapping—proved particularly powerful for targeting core competencies and translating organizational needs into measurable learner results. Simulation-based teaching, integrated with other adult learning modalities under Kern's framework, was central to bridging theoretical knowledge and real clinical performance, a finding echoed across current systematic research (Ghasemimilsefid et al., 2025; Sreedharan et al., 2024).

Perhaps most significantly, the model demonstrated equitable benefit, with no significant difference in gains across gender or nationality—a key marker of scalable, fair professional development. This is crucial for diverse, multinational hospital settings (Jones et al., 2023).

Stakeholder feedback confirmed the relevance and perceived value of Kern-based curriculum design, with almost all participants rating course content, structure, and instructor quality positively.

CONCLUSION

This evaluation shows that Kern's Six-Step Curriculum Development framework provides a robust, evidence-based foundation for creating competency-based respiratory therapy education that meets both organizational and learner needs. The approach delivers substantial improvements in knowledge, skill acquisition, and clinical confidence, evidenced by strong, equitable gains in standardized examinations and OSCEs. High satisfaction levels among both staff and faculty confirm the model's educational and practical value.

Simulation-based education—emphasized within the Kern model—was vital to achieving these gains and is strongly recommended for similar advanced professional programs. Future work should further explore longitudinal outcomes and curriculum durability across multiple sites.

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