

## Abstract

### **The integrated simulation and technology enhanced learning (ISTEL) framework: facilitating robust design, implementation, evaluation and research in healthcare**

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**Relevance:** Technology enhanced learning<sup>1</sup>, simulation<sup>2</sup> and instructional design<sup>3</sup> models, have previously been used to guide the development of some healthcare initiatives. To date there is no evidence of a framework to facilitate the design, development and evaluation of simulation and technology enhanced learning (STEL) in physiotherapy.

**Purpose:** A sequential, two phased explanatory mixed methods study was selected to provide a comprehensive examination of the use of simulation-based education (SBE) in cardio-respiratory physiotherapy in the United Kingdom (UK).

**Methods/analysis:** Phase 1 consisted of two national surveys pertaining to the use of SBE in cardio-respiratory physiotherapy education (pre- and post-registration curricula and acute respiratory/emergency on-call training)<sup>4</sup>. Findings of these surveys were used to develop the resources that were integrated in phase 2. Phase 2 used focused video-reflexive ethnography to explore behaviours, error recognition abilities and personal experiences of 21 final year (pre-registration) physiotherapy students from one Higher Education Institution<sup>5</sup>. The methodological design of the study was informed by social constructivist and socio-material (complexity) theoretical perspectives. Thematic analysis of 12 simulation scenarios and the corresponding video reflexive interviews were undertaken.

**Results:** The integrated simulation and technology enhanced learning (ISTEL) framework was developed by synthesising the literature focusing on theoretical perspectives and educational practices that inform the preparation, intervention and research/evaluation of STEL, phase two methodological design and analysis. The ISTEL framework integrates three distinct but interlinking, essential components to be considered when designing, developing, implementing and evaluating or researching STEL. These include: preparation, intervention and evaluation or research. These three components are further divided into 7 elements:

- 1. learner,
- 2. facilitator,
- 3. theory and educational practices,
- 4. learning design characteristics,
- 5. pre-brief and debrief,
- 6. linked learning activities and
- 7. outcomes.

Attention is drawn to the value of outlining theoretical perspectives and educational practices that underpin STEL in education and research. The identification of linked learning activities following the debrief, offers opportunities for further reflection and translation of learning to clinical practice.

**Discussion and conclusions:** The ISTEEL framework emphasizes the importance of ensuring appropriate theoretical and educational practices underpin the design, preparation, implementation and evaluation of STEL interventions; whether this be for a scenario, short course or embedded within healthcare curricula. The ISTEEL framework highlights the importance of adopting an integrated approach to the design, development and evaluation or research of STEL in physiotherapy and other healthcare disciplines.

**Impact and implications:** Robust design, preparation and evaluation of the STEL intervention are vital to evidence the impact and value of STEL in physiotherapy and other healthcare disciplines. It is anticipated that the use of the ISTEEL framework may also help to facilitate structure and transparency when articulating STEL design, intervention, and outcomes demonstrated, which, in turn, may facilitate future comparative analysis and replication. Further testing of this framework is currently being undertaken in physiotherapy and other healthcare disciplines.

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