Learning Critically & Confidently from Productive Mistakes

A Proposal to provide a confidence-based self-assessment calibration tool that promotes metacognitive skills and enhances critical reasoning

Area of Concentration: Our Proposal overlaps the 3 areas of concentration of the department – Innovative Pedagogy; Simulations, and Assessment/Outcomes Research

Interdisciplinary UCF Team members:

Med Education Dept.:	**Philosophy Dept.:**	**Institute of Simulation and Training:**
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Background/Motivation

One of the main goals of medical educators is to train future physicians to successfully adapt and respond to challenging clinical situations under constraints - in practice. An important barrier is the recognition that medicine, based in *flash and blood decision-making* (Reason, 1990) includes both cognitive and affective biases as additional challenges to the development of effective medical education strategies under constraints (Croskerry, 2005).

One positive contributing factor to the quality of a practitioner's medical decision-making is one's constant ability to self-assess against uncertainty in a case-by-case basis. Metacognition is a necessary skill for successful self-monitoring and for refining action in context - pointedly regarding the avoidance of unnecessary and/or harmful medical interventions (Papa et al, 1999; Wachter et al, 2004). Within the breadth of metacognition, critical reasoning, as the ability to reflect and apply normative standards of reasoning to problem solving, is a fundamental skill for avoiding many biases, and in particular, the Dunning-Kruger effect (1999) - the bias of overconfidence. This bias prevails when the subject disregards the gaps in her knowledge base and acts confidently, against prudence and safety.

In order to develop a strong metacognitive, critical reasoning capacity, a medical student needs both to 1) revise her confidence level in her every decision (when appropriate) - or learning response - in the context of the relevant piece of training in a progression of expertise development, and 2) be able to learn productively from mistakes in different case scenarios, in practice - while not harming patients. Yet, given the uncertain nature of the clinical contexts as well as personal biases, it is often very difficult for a medical student to correctly calibrate their knowledge under constraints, while also becoming systematically aware of metacognitive challenges to one's decision-making. In this proposal, in order to contribute to the development of new strategies to safely and ethically help students to productively recognize biases as personal factors and learn from their mistakes while better self-assessing, we suggest to develop an innovative student self-assessment instrument, to help students learn from their mistakes in a critical reasoning key, in simulated, protected patient-centered information environments.

We suggest to integrate both the wealth of three decades of concept inventory models (since the pioneer work on science education of Halloun & Hestenes, 1985) for identifying scientific misconceptions and possible biases for medical students in specific clinical areas, allied to a confidence-based response inventory, in an embedded metacognitive learning simulation framework (Fiore & Vogel, 2012) for students to identify how confident they really are of their actions, and better qualify and distinguish guesses from solid understanding, in practice. The design of this tool will be integrated with Miller's Pyramid Model (1990) for UCF undergraduate medical curriculum development, following the decision of the LCT Sub-Committee in November 2015.

Research Plan

A concept inventory is a diagnostic test of learning designed to determine whether a student has an accurate working knowledge of a specific set of concepts. Extensive research and development is needed to produce an instrument with high reliability and validity and to set the passing standards.

Phase 1: Informal interviews with faculty experts to establish the scope of expected learner capability at particular stages in training and critical areas for testing (initial focus is M2 pre-clerkship student prior to entering hospital training environment) [Timeline – 3 months; IRB approval prior to starting project]

Phase 2: Development of specific learning objectives; validate with sample of faculty interviewees [Timeline – 1 month]

Phase 3: Item development and review; 3 items per objective, peer reviewed [Timeline – 2months]

Phase 4: Pilot test with students. Will be done after sequence of M2 simulation sessions in which students make therapeutic decisions such as fluid regimens and drug treatments. Students give reflective interview and take pilot test; statistical reliability of test and items is determined and validated against student transcripts for meaning. [Timeline – pilot data and analysis 3 months]

Phase 5: Edit instrument and retest [Timeline 2 months]

Phase 6: Manuscript preparation [Timeline 1 month]

Deliverables

Innovative educational tool; Pilot; Research Manuscript; Interdisciplinary team formation

Budget and justification of financial support

Data analysis software: Nvivo 11 Pro License and online training package [Two needed] = $2120
Simulation consumables for pilot testing: $500
Adobe Illustrator Suite Software Subscription for visual representation design 12 x $15 = $ 180
Student participation incentives for interview and pilot testing: 120 students @$25 per hour = $3000
Travel for conference presentations and manuscript preparation for two team members = $3000
Laptop computer for the PI to travel between sites, to have the ability to manage the analytic software: $1,200
Total = $10,000