

*Application and evaluation of  
advanced simulation with HPS in  
developing student's critical  
thinking dispositions and skills:  
The progress*



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- Other members of the study team
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  - Ms Cecilia Kong (Clinical Instructor)



# Background

- From the Faculty Retreat 2007
  - need to strengthen the competitiveness of Bachelor of Nursing programme, given the keen competition for good candidates due to the increase student numbers.



# Our Mission

- *advancing teaching and learning in the art and science of medicine and health; and*
- *fostering and managing an environment conducive to the teaching and learning of nursing, which promotes the health, well-being, and development of students, staff, and clients.*



# Advanced Human Patient Simulator (HPS)

- aid excellence in providing an advanced tool to teach and learn, and objectively measure competency in the application of knowledge and clinical skills of baccalaureate and graduate students (Nehring, Ellos, & Lashley, 2001; Nehring, Lashley, & Ellis, 2002)



# Advanced: “Hi-Fi”

- High-Fidelity
  - “able to produce sound with little or no distortion” (The Free Dictionary, 2008)
  - The ability to *reproduce the situation accurately for experiential learning* through the advanced simulation & subsequent debriefing



# Experiential Learning

- *Experiential learning*: The change in students with new abstractions and applications, which results from reflection on the direct learning experience (Kolb, 1984).
- With the advanced simulation technology in our case: Students are provided with very realistic simulation for experiential learning and *reflection* of their learning through *debriefing*.



# From the Nursing & Medical Literature

(Bearnson & Wiker, 2005; Bremner, Aduddell, Bennett, & VanGeest, 2006; Nehring & Lashley, 2004; Tan, Ti, Suresh, Ho & Lee, 2002; Ti, Tan, Khoo, & Chen, 2006; Steadman et al., 2006)

- Evaluation on the use of HPS in nursing education is not long in time
- Indicated the willingness and an positive trend of medical / nursing students and educators in acquiring and applying the advanced simulation technology in teaching and learning
- The results of current studies showed a promise of establishing the foundation for best practices with the use of HPS in baccalaureate nursing education, particularly for the novice students





# The Value

- Patient safety: Practice without risk
- Education on demand: Standardized curriculum
- Acceleration of expertise: Practice makes perfect (Chen, 2008)



# Opportunities for Nursing Education & Scholarship

- Literature on the use of HPS in nursing curriculum is sparse (Nehring & Lashley, 2004; Bremner, Aduddell, Bennett, & VanGeest, 2006)
- Evaluation and research in nursing education with HPS < 10 years
- Promising evidence in the nursing literature (more in the medical literature)



# Department's Goals

- *To enhance teaching and learning of clinical nursing skills in the nursing curriculum, which is a centre piece of nursing practice;*
- *To equip our teaching team and students with the state of the art hi-fi HPS, which is capable of providing multiple functions and creating scenarios for *experiential learning* of health assessment, clinical skills, clinical decision making, and life support; and*
- *To match in line with one of the University's strategic directions of “deploying new technologies in advancing teaching, learning and scholarship” (Tsui, 2002).*



# Our Plan & Progress (1/3)

- Applied the University Development Fund (UDF) and \$2.484m was granted in May 08 to acquire 5 sets of HPS (SimMan)



A Set of SimMan  
Universal Patient  
Simulator  
(Picture used by  
permission:  
Goodwin Health  
Care)



# Our Plan & Progress (2/3)

- Alterations of our 5 skills laboratories (5 control rooms for 5 SimMans constructed in Jan 09)



# Our Plan & Progress (3/3)

- Secured curtain systems installed
- Establishing a Steering Committee of the Clinical Skills Training Centre in Mar 09
  - To plan for the training of staff
  - To review our clinical laboratory teaching in clinical nursing courses with the new SimMans
  - To explore potentials & new activities with the SimMans
- Implementation of the new approach of teaching & learning (S1 2009/2010)
- Evaluation of outcomes (a TDG Proposal applied and commenced in Sept 09)



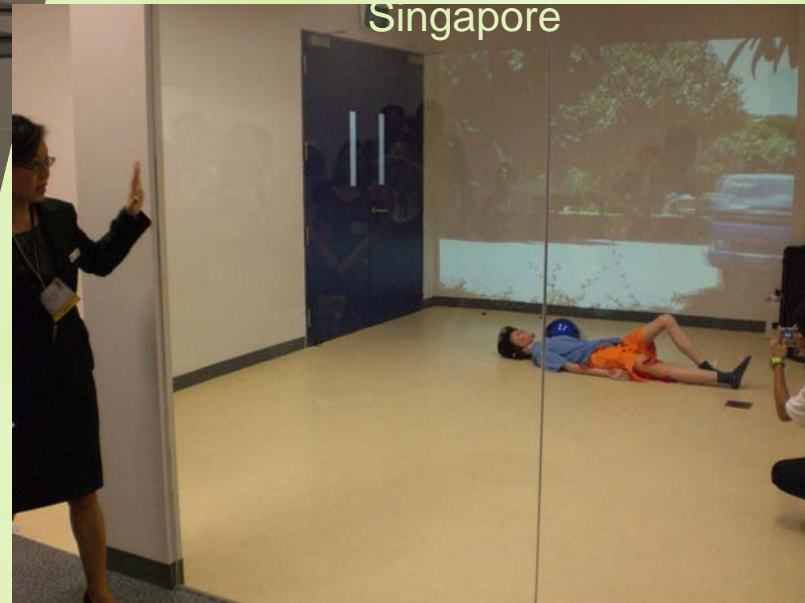




In our lab



Source: Institute of Technical Education (ITE) College East, Singapore







Our labs



# Debriefing after the HPS Exercise

(NY Polytechnic School of Health Sciences,  
Courtesy of Chen, 2008)



# Debriefing



Our labs



Source: Institute of Technical Education (ITE) College East, Singapore



# A Video Payback for Debriefing

Laerdal Debrief Viewer - [2009-0-7.581]

File Option Help

## Debriefing

Date: 08.05.2009 Time: 17:09:12

### Diabetic Hypoglycemia

00:00:00 Scenario started: Diabetic Hypoglycemia  
00:00:00 Name: Skyler Hansen Age: 18 years Weight: 70 kg Height: 72 inch C  
Description: Prior medical history: Diagnosed with type 1 diabetes a  
6 months ago. Immunizations are current. No known medical or tra  
00:00:00 Handler started: Diabetic hypoglycemia  
00:00:00 Handler started: 900  
00:00:00 HR: 84 BP = 112/70 SpO<sub>2</sub>: 99  
00:00:00 Simulation passed  
00:00:00 Simulation resumed  
00:00:15 Simulation paused  
00:00:15 Simulation resumed  
00:00:52 obtain fingerstick glucose  
00:00:52 ✓  
00:00:52 Labs displayed: laerdal\_glucometer\_38.jpg "Labs 1"  
00:01:00 HR: 84 BP = 112/70 SpO<sub>2</sub>: 99  
00:01:07 obtain VS with SpO<sub>2</sub> level  
00:01:12 ECG leads attached  
00:01:17 NBP cuff attached  
00:01:39 introduce self  
00:01:38 ✓ Introducing self to patient and family members initiates the m  
relationship. A proper introduction not only includes name but also t  
patient knows who is providing care. A name badge should also be  
to the patient.  
00:02:00 HR: 83 BP = 112/70 SpO<sub>2</sub>: 99  
00:02:22 BP auscultated: BP 112/70  
00:02:33 communicates directly with physician  
00:02:54 BP auscultated: BP 112/70  
00:03:00 HR: 80 BP = 112/70 SpO<sub>2</sub>: 99

Level of Detail

Play Time: 6:45

Sound View

Exit Save



## The Study: Evaluating advanced simulation for experiential learning in developing student's critical thinking dispositions and skills

- Aims

- to identify issues and experiences from students to further improve such T & L approach (formative), and
- to evaluate the student's development of critical thinking dispositions and skills with the new approach of advanced simulation for experiential learning (summative).



# Objectives

1. To identify and evaluate any development or changes in critical thinking dispositions and skills during the period commencing first Semester to the end of second Semester (2009/10) when the relevant courses completes;
2. To identify and evaluate any development or changes in students' learning approaches during the period commencing first Semester to the end of second Semester (2009/10) when the relevant courses completes;
3. To understand the experiences of student's learning with the new T & L approach after completion of the courses involved; and
4. To recommend curriculum improvement in the T & L of clinical skills and the clinical decision making skill.



# The Method & Design

- Pre – post evaluation
- Recruitment
  - All Year 2 students in BNurs (FT) programme who will do, in 2009/10,
    - Nursing Care of the Adult I
    - Nursing Care of the Adult II
- Sample Size Estimation
  - 180-190 enrolments
  - Estimated 50-70% will provide consent (n = 90-133)
  - Power analysis
    - Power = 80%,  $p = 0.05$ , SD for change = 30 and the effect size (change of the total score of CCTDI) = 9:  
Required n = 89



# Instruments

- California Critical Thinking Disposition Inventory (CCTDI)
- Two-factors Revised Study Process Questionnaire (R-SPQ-2F)
- Holistic Critical Thinking Rubric Score (HCTSR)
- Focus Group interviews





# California Critical Thinking Disposition Inventory (CCTDI)

- Measuring the key theoretical dimensions of the disposition of critical thinking (7 sub-scales)
- A Chinese version (Tiwari, Avery, & Lai, 2003)
- Cronbach  $\alpha = 0.7$  (sub-scales 0.46 – 0.74)
- A total score of 280 or above suggest a positive disposition



# Two-factors Revised Study Process Questionnaire (R-SPQ-2F)

- A 20 questions (4 sub-scales) instrument evaluates what student does in terms of their ongoing approaches to learning, i.e. Deep or Superficial Approach (DA or SA) (Biggs, Kemper & Leung, 2001)
- Confirmatory factor analysis
- Cronbach  $\alpha = 0.73$  for DA & 0.64 for SA



# Holistic Critical Thinking Rubric Score (HCTSR)

- Qualitatively assessing student's critical thinking skills and dispositions (6 elements considered for each score which is expressed in a range of min 1 to max 4) (AHA, 1990; Facione & Facione, 1994)
- Also assesses student's dispositions to pursue evidence and reasons, open-mindedly or fair-mindedly, in order to reach good and objective decisions for complex problems (Tiwari, Chan, Sullivan, Dixon & Tang, 1999)



# Focus Group Interviews

- Formative evaluation of the two courses involved in this study (Nursing Care of the Adult I and II)
- Conduct focus group interviews with 6 – 8 students (n = 36 – 48 students) and 3 – 4 teachers (n = 11) per group
- Essential for continuous improvement of the advanced simulation for experiential learning approach



# Timeline and Procedures

	Sept 09 (T1)	Sept - Nov 09	Nov/Dec 09 (T2)	Nov/Dec 09	Jan - May 10	Jun 10 (T3)	July/Aug 10	Sept - Dec 10
Nursing Care of the Adult I	Demo + CCTDI + RS-SPQ-2F	1 <sup>st</sup> data entry + analysis	CCTDI + RS-SPQ-2F	2 <sup>nd</sup> data entry + 3 focus group interviews + HCTSR analysis	Generating quantitative results + Transcription and qualitative analysis	Generating qualitative results	--	--
Nursing Care of the Adult II	--	--	--	--	--	CCTDI + RS-SPQ-2F	3 <sup>rd</sup> data entry + 3 focus group interviews + HCTSR analysis	Transcription + finalizing analyses and results <u>Dec</u> Report



# Focus Group Interview Questions (Semi-structured)

1. Overall, what has been your experience in studying this course?
2. What has been your experience about the use of advanced HPS and scenario-based simulation for teaching and learning in this course?
3. How do you feel about the use of advanced simulation for teaching and learning in this course?
4. Have you noticed changes in your learning approaches after the use of advanced simulation for teaching and learning in this course?
5. What may be improved for better teaching and learning of this course?



# The Evaluation Methods

- Quantitative
  - Paired t-tests: T1, T2 and T3 (CCTDI & R-SPQ-2F)
  - One-way ANOVA: Total and sub-scale mean scores of the CCTDI between S1 and S2
  - Pearson Correlation: Association of GPA with CT dispositions at the end of relevant academic year
  - Cross-reference and contrast: HCTSR vs t-test results
- Qualitative
  - Transcription
  - NVivo 2.0 for coding & analysis



# Initial Results (1/4)

## Percentages of CCTDI Sub-scores

	Percentages below scale score of 40 (%)		Percentages above scale score of 50 (%)	
	T1 (n=87)	T2 (n=88)	T1 (n=87)	T2 (n=88)
Truth-seeking	98.5 (60)	89.8 (60)	0.0 (2)	1.1 (2)
Open-minded	90.9 (15)	89.8 (15)	0.0 (28)	0.0 (28)
Analyticity	73.5 (23)	69.3 (23)	0.8 (16)	1.1 (16)
Systematicity	96.2 (44)	87.5 (44)	0.8 (11)	0.0 (11)
Confidence	67.4 (25)	63.6 (25)	2.3 (19)	4.6 (19)
Inquisitiveness	32.6 (14)	45.5 (14)	6.8 (41)	5.7 (41)
Maturity	57.6 (17)	76.1 (17)	1.5 (29)	2.3 (29)
	Percentages below scale score of 280 (%)		Percentages above scale score of 350 (%)	
	T1	T2	T1	T2
Overall	87.9 (22)	87.5 (22)	0.8 (6)	0.0 (6)

Percentages in ( ) denotes the results from a sample of 267 under-graduates elsewhere (Facione & Facione, 2007)





# Initial Results (2/4)

## Paired t-test of T1 and T2 CCTDI scores

n = 87

	Paired t-test	p-value
Truth-seeking	-.532	.596
Open-minded	-.558	.578
Analyticity	-1.118	.267
Systematicity	-2.579	.012
Confidence	-1.033	.304
Inquisitiveness	.139	.890
Maturity	1.741	.085
Overall	-.539	.591

## Paired t-test of T1 and T2 Learning Approaches (R-SPQ-2F)

n = 126

	Paired t-test	p-value
T1-Deep Approach x T2-Deep Approach	-3.247	.001
T1-Surface Approach x T2-Surface Approach	-2.226	.028
T1-Deep Motive x T2-Deep Motive	-2.287	.024
T1-Deep Strategy x T2-Deep Strategy	-3.576	.000
T1-Surface Motive x T2-Surface Motive	-1.808	.074
T1-Surface Strategy x T2-Surface Strategy	-2.254	.026

Cronbach's alphas of R-SPQ-2F at T1 = 0.724 & T2 = 0.826



# Initial Results (3/4)

## Correlations of DA / SA and CCTDI at T1

n = 81	DA correlation (sig.)	SA correlation (sig.)
Truth-seeking	-.236 (.039) *	-.059 (.618)
Open-minded	.103 (.372)	.088 (.455)
Analyticity	.258 (.024) *	.076 (.515)
Systematicity	.035 (.762)	.118 (.315)
Confidence	.327 (.004) *	.018 (.075)
Inquisitiveness	.202 (.078)	-.250 (.030) *
Maturity	.211 (.065)	-.065 (.582)
Overall score	.255 (.022) *	-.017 (.882)

## Correlations of DA / SA and CCTDI at T2

n=75	DA correlation (sig.)	SA correlation (sig.)
Truth-seeking	.065 (.581)	-.153 (.190)
Open-minded	.121 (.300)	-.270 (.019) *
Analyticity	.307 (.007) *	-.046 (.696)
Systematicity	.243 (.036) *	-.013 (.909)
Confidence	.295 (.010) *	.000 (.998)
Inquisitiveness	.314 (.006) *	-.163 (.163)
Maturity	-.057 (.629)	-.232 (.045) *
Overall score	.333 (.003) *	-.224 (.054)

\*  $p \leq 0.05$



# Initial Results (4/4)

- **General Comments from Users** (from focus group interviews after the NCA I course)
  - **Students** (2 groups @ 3 – 5/group)
    - Interesting and useful for learning
    - Better to have more introduction of the SimMan's capabilities before exercise
  - **Teachers** (2 groups @ 3 – 5/group)
    - Need some time to learn using the advanced equipment in the beginning
    - Useful for teaching, in particular in clinical thinking and clinical decision making



# Findings

- The new advanced simulation T & L were welcomed and found useful by both students and teachers
- Percentages of CCTDI below 280 at T1 and T2 were both higher than the comparison group elsewhere
- Percentages of CCTDI above 350 at T1 and T2 were both lower than the comparison group elsewhere
- No significant difference between overall CCTDI at T1 & T2 (n = 87) except *systematicity* (p=0.012)
- HCTSR of simulation at T2 indicated 4 occasions of score 2 out of 5 exercises (more being assessed)
  - CCTDI < 280 at T1 = 87.9% & T2 87.5%
  - CCTDI > 350 at T1 = 0.8% & T2 = 0%
- DA, SA, DM, DS & SS significantly increased from T1 to T2 (Cronbach's alphas at T1 & T2 = 0.724 & T2 = 0.826)
- DA was significantly correlated to CCTDI overall scores at both T1 & T2



# Discussion

- Increased *systematicity* but not the overall CT disposition at T2 after Semester I, 2009/10, awaiting data collection at T3
  - Sufficient dosage of the simulation exercise?
- Level of CT as assessed collectively by HCTSR at T2 somewhat consistent with the results comparing the CCTDI scores of T1 with T2
- Signs of increasing learning approaches (both DA & SA) after Semester I, 2009/10
  - Common in increasing both DA & SA among university students during their course of study (Lizzio, Wilaons & Simons, 2002)
- As found in other studies: Advanced simulation with HPS for T & L is commented as interesting and useful, and welcomed by students & teachers in general
- **Limitations**
  - Unable to obtain case control
  - Insufficient dosage?



**Thank You &  
Comments Welcomed.**



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