Effectiveness of Simulation-Based Training: Evidence and Outcomes

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Desired Benefits of Simulation-Based Training

- Risk to patients is reduced
- Training addresses a wide range of relevant knowledge, skills, and attitudes (KSAs)
- Training is more widely available
- Training is more consistent and interference is reduced
- Transfer to real situation is increased
- Assessment is more consistent and skill-oriented
- Cost is reduced
## What are We Looking For?

**Kirkpatrick’s Four Levels of Evaluation**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Surveys</td>
<td>Did the trainees like it?</td>
</tr>
<tr>
<td>2</td>
<td>Assessments</td>
<td>Did the trainees learn?</td>
</tr>
<tr>
<td>3</td>
<td>Transfer</td>
<td>Are there behavioral changes?</td>
</tr>
<tr>
<td>4</td>
<td>Benefits</td>
<td>Are there clinical outcomes?</td>
</tr>
</tbody>
</table>

*(Is the training good?)*

*(Does the training have the desired effect?)*
Example Successes: Military and Aviation Training
Flight Simulators
Why Flight Simulators are Effective

- They accurately replicate the important features of the cockpit experience
- Simulators are less costly and more available than real aircraft
- Aircraft behavior is consistent and predictable
“Top Gun” School

Air-to-Air Loss/Exchange Ratio

- USN 12.5:1
- No Air-to-Air Combat

1965-1968:
- USN: 2.4:1
- USAF: 2.3:1

1969:
- USN: 2.0:1

1970-1973:
- USAF: 2.0:1
Objective: 16 weeks of simulation-based, “intelligent” training to produce graduates who are superior to technicians with 7 years of IT experience in the Navy.
Evaluation Results: Troubleshooting Skill

<table>
<thead>
<tr>
<th>Test group</th>
<th>Problems attempted</th>
<th>Problems verified</th>
<th>Correctly solved</th>
<th>Rated excellent</th>
<th>Rated harmful</th>
<th>Solutions tested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fleet professionals</td>
<td>95</td>
<td>81 (83%)</td>
<td>79 (83%)</td>
<td>46 (48%)</td>
<td>18 (19%)</td>
<td>73 (77%)</td>
</tr>
<tr>
<td>Trainees</td>
<td>102</td>
<td>99 (97%)</td>
<td>99 (97%)</td>
<td>89 (87%)</td>
<td>8 (8%)</td>
<td>97 (95%)</td>
</tr>
</tbody>
</table>

All differences statistically significant at $p < 0.01$
Operational Language and Culture

- Game-based foreign language and culture training
- Part-task training in communication skills
- Practice simulated missions, interacting with virtual host nationals
3rd Battalion/7th Regiment completed 2007 tour of duty in Iraq, without any combat casualties

- First Marine battalion achieving this level of success

Marine Corps Center for Lessons Learned interviewed officers, surveyed Marines upon returning from Iraq

Findings:

- 2 marines in each squad trained 40 hrs with Tactical Iraqi
- Knowledge of Iraqi language and culture contributed directly to mission success
  - E.g., enabled marines to develop rapport with populace
Results from Medical Training
Laparoscopy Simulator Study

- 100 medical students completed 6 tasks 3x on MIST-VR simulator
- Students compared against 12 experienced and 12 inexperienced laparoscopic surgeons
- Metrics: time to complete task, economy of movement, economy of diathermy use
- Results compared to experienced surgeons:
  - Students performed with same economy of diathermy, error, & right instrument
  - Students’ speed increased with trials, but was slower than experienced surgeon group
Diabetes Self-Care Study

- 59 diabetes patients, ages 8-16
- Experimental group (n=31): played game with diabetes content
- Control group (n=28): played entertainment game
- Results for experimental group vs. control group:
  - Improved communication with parents ($p < 0.025$)
  - Improved self-care behaviors ($p < 0.003$)
  - Marginally improved self-sufficiency ($p < 0.07$)
  - Marginally fewer unscheduled doctor visits ($p < 0.08$)
References


