Learning By Example

Empirical Designs in Efficacy Research on Hybrid and Online Medical Education

Greg Brandes, Dean, St. Francis School of Law

Online and Hybrid Learning Pedagogy:
Toward Defining Best Practices in Legal Education
September 26 – 28, 2019
Actions and Activities Serve-up Outcomes

Specific Course and Program Outcomes:

- Substantive Law
- Thinking Like a Lawyer
- Critical Thinking
- Writing
- Client Interaction
- Professional Values
- Skills
Study #1 Medical Education Background

• Learning Outcome: Physician Clinical Reasoning (collect and process patient’s medical situation, plan and implement medical interventions, evaluate outcomes, and learn from the experience.)

• Teaching methodology: Case-based learning

• Assessment: “Key feature questions” (KFXs) evaluate long-term retention of knowledge, skills, and clinical application of knowledge. KFQs assume that each clinical presentation has certain unique, essential elements that expert practitioners recognize and act upon in clinical reasoning decisions.
Study Design:

• 100 4th year medical students provided consent
• 75 completed all formative exams: entry, exit, and retention (unannounced, 4 months after the 9 exit exam)
• “After 1 electronic case seminar (ECS) introducing text- and video-based case presentations (ECS 0), 8 weekly intervention ECSs with the free choice of learning format were conducted (ECS 1-8).”
• 27 case histories, in all, were presented. All patient case histories were available in either text-based or video-based format.
• Students chose text (52) or video (23) presentation.
• 5 key feature questions followed each case presentation; 135 total.
I'm constantly out of breath.
Study Results:

The graph shows the comparison of format attendance (%) between text and video formats over eight intervention ECS intervals.

- **Text format**: The line with filled circles shows a gradual increase in format attendance from 20% to 90% over the eight intervals.
- **Video format**: The line with dashed circles indicates a decrease from 90% to 10% over the same intervals.
Study Results:

- Mean achieved score (%)

<table>
<thead>
<tr>
<th>Exam Type</th>
<th>Text Preference</th>
<th>Video Preference</th>
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<tbody>
<tr>
<td>Entry exam</td>
<td>30</td>
<td>20</td>
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<tr>
<td>Exit exam</td>
<td>80</td>
<td>70</td>
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<tr>
<td>Retention exam</td>
<td>60</td>
<td>50</td>
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</tbody>
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*P < .5
Study Results:

Mean achieved score (%)

- Text preference
- Video preference

*P<.5

<table>
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<tr>
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<th>Entry</th>
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Study Results:

Mean achieved score (%)

- Entry
  - Text preference: 20
  - Video preference: 20

- Exit
  - Text preference: 80
  - Video preference: 80

- Retention
  - Text preference: 60
  - Video preference: 60

*P<.5
Study Results:

“In the entry and exit exam, there was no significant difference in percent scores between students preferring video-based items and students preferring text-based items (entry exam: 31.1% [SD 12.3] vs 29.4% [SD 12.3]; $P=.59$; exit exam: 76.2% [SD 12.6] vs 70.0% [SD 19.0]; $P=.15$). In the retention exam, students who had preferred videos during the intervention phase scored significantly higher than students preferring text-based items (75.3% [SD 16.6] vs 63.4% [SD 20.3]; $P=.02$; see Figure 3).”
Also Note:

1. Researchers analyzed the data for differences in:
   - Age at entry to the study
   - Attendance at intervention ECS’s
   - Percent score achieved in exams during the previous term

No significant differences were observed. (Controls, but also interesting demographically.)

2. Students were not randomized by the researchers; instead, self selection was part of the test and findings.

https://mededu.jmir.org/2019/2/e13386/
Study #2 Medical Education Background

• Learning Outcome: Nursing Clinical Reasoning (collect and process patient’s medical situation, plan and implement medical interventions, evaluate outcomes, and learn from the experience.)

• Teaching methodology: Case-based learning, and simulation.

• Assessment: True-false and multiple choice knowledge tests. I pretest and 2 posttests, one immediately after the intervention and one 2 months later.
Study Design:

• 56 second-year Portuguese nursing students randomly assigned to experimental (n=28) and control (n=28) groups.

• Same Instructors, different strategies:
  • Both Groups: Lab class of 45 minutes on respiratory process
  • Experimental Group: Clinical Virtual Simulator (Body Interact)
  • Control Group: Low-fidelity simulator, in a realistic environment

• Seven from each group were lost to missed classes or follow-ups.

• Analyzed (n=21) experimental and (n-21) control groups

• Pretest, exit, and retention (2 months after the intervention) exams
Study Design:

“Clinical virtual simulation brings together such strategies as gaming and problem-based learning, using an interactive and dynamic 3-dimensional technology that encourages active and critical action-based learning.”
Study Results:

“The results of the students’ t tests showed the existence of statistically significant differences in knowledge retention after the intervention ($t_{40}=-3.656; P=.001; d=1.13$), knowledge retention 2 months later ($t_{40}=-2.439; P=.02; d=0.75$), and in learning satisfaction ($t_{40}=-4.309; P<.001; d=1.33$). The students in the experimental group presented better outcomes in knowledge retention and learning satisfaction than students in the control group.”
Study Results:

“Clinical virtual simulation enabled a 20.4% improvement in students’ knowledge retention and clinical reasoning in the context of the study. This study showed that clinical virtual simulation is a pedagogical strategy that, combined with other strategies such as briefing, simulation, and debriefing, improves both initial knowledge retention and knowledge retention over time.”
Also Note:

1. Researchers analyzed the data for differences in:
   • Age at entry to the study (19.9 years, on average)
   • Gender (95% female)
2. Students were randomized by the researchers (via SPSS); thus it would be expected that the mix of academic acuity would also be random, too.
3. This study also included a satisfaction with learning measure, and just like most studies, students using the virtual clinical simulator were more satisfied.
Padilha JM, Machado PP, Ribeiro A, Ramos J, Costa P; Clinical Virtual Simulation in Nursing Education: Randomized Controlled Trial; J Med Internet Res 2019;21(3):e11529

https://www.jmir.org/2019/3/e11529/?utm_source=TrendMD&utm_medium=cpc&utm_campaign=JMIIR_TrendMD_0
Study #3 Medical Education Background

- Learning Outcome: Emergency Medicine Clinical Reasoning (collect and process patient’s medical situation, plan and implement medical interventions, evaluate outcomes, and learn from the experience.)
- Teaching methodology: In-person simulation.
- Assessment: Raters (physicians and nurses) trained on the checklists used in the simulation, observing behind two-way glass or via audiovisual recordings, marking checklist items as either “observed” or “not observed”.
Study Design:

• 58 volunteer non-emergency medical residents randomly assigned to app (n=29) and control (n=29) groups. Only app group participants used the airRX app.

• Two simulated in-flight medical emergencies: shortness of breath and syncope (fainting or passing out)

• Checklist item success rates, key critical action times, global rating scales (GRS), and pre-post simulation confidence in managing in-flight medical emergencies were compared.

• Simulations featured standardized patient and flight attendant actors, and a Boeing 737 cabin setting.
Study Design:

- Stratified Randomization by Post Graduate Year and Specialty

App Group N=29 → Pre Self-Efficacy Survey → App Intro → SOB → Syncope → Post Survey Self Efficacy

CL, GRS

No App Group N=29 → Pre Self-Efficacy Survey → SOB → Syncope → Post Survey Self Efficacy

CL, GRS
Study Design:

**Global Rating Scale:** The 4-point GRS (1=needs further instruction, 2=competent but with close supervision, 3=competent with minimal supervision, and 4=competent to perform independently) measures competence in managing the scenario and is similar to the entrustable professional activities scale used in undergraduate medical education [23].

**Validity and Reliability:** Real flight attendant were used both to train the standardized flight attendant actors for the scenario and to verify the scenarios.
Study Design:

Checklist Items: Flight attendants (MC), aviation (MDS, CT, and PA), and emergency medicine experts (NN, WB) led the development of optimal performance expectations reflected in scenario-specific rating forms, including both checklists and GRS. These were cross-checked for content validity by having other team members (MDS, RB) review the checklist items. Items included history gathering, physical examination, basic management choices, and communications actions.
“The app group had a significantly higher mean percentage of total completed checklist items (mean 58.0, SD 8.1) compared with the control group (mean 49.8, SD 7.0) for the syncope scenario ($t_{56}=4.15$, $P<.001$) and the shortness of breath scenario (mean 56.1, SD 10.3 versus mean 49.4, SD 7.4 for control; $t_{56}=2.82$, $P=.007$).”
Study Results:

“For both cases, the app group demonstrated significantly greater requests for ground medical control, flight attendant assistance, and communications to inform and update the cabin crew. For the shortness of breath case, the app demonstrated significantly greater administration of steroids, administration of high flow oxygen, and communications to inform and update the cabin crew. However, the control group completed the cardiac and pulmonary exams and reassessed vitals more frequently. For the syncope case, the app group asked about dyspnea and palpitations, positioned the patient supine, and administered oxygen more frequently compared with the control group (Table 2).”
Study Results:

“For timed actions, the app group had significantly shorter response times for the “alert ground medical support” checklist item compared with the control group, and this was statistically significant for both cases (\(P=.01; \text{Table 3}\)). However, the control group for the shortness of breath case had a statistically significant shorter response time for the “obtains vitals” checklist item (\(P=.006; \text{Table 3}\)). Comparing the performance of learners across the two groups, there was no significant difference in the GRS for the shortness of breath case; however, the app group was rated significantly higher (mean 3.14, SD 0.89) for the syncope case compared with the control group (mean 2.6, SD 0.97; \(P=.003; \text{Figure 3}\)).
Also Note:

1. Analysis of participant demographics did not show differences in specialty, level of training, experience flying, or experience with in-flight medical emergencies (Table 1) between the two groups.

2. The mean interrater reliability across the entire case was 0.90 for the syncope case and 0.94 for the shortness of breath case.
Nadir NA, Cook CJ, Bertino RE, Squillante MD, Taylor C, Dragoo D, Podolej GS, Svendsen JD, Fish JL, McGarvey JS, Bond WF; Impact of an Electronic App on Resident Responses to Simulated In-Flight Medical Emergencies: Randomized Controlled Trial; Jmir Med Educ 2019;5(1):e10955

https://mededu.jmir.org/2019/1/e10955/
Effects of Evidence-Based Best Practice

• Efficacious
• Efficient
• Economical
• Repository
Phases of Research Design and Conduct

- Hypothesis
- Study Design
- Team Recruitment
- Stats Design
- Human Subjects / IRB
- Funding

- Subject Recruitment
- Subject Randomizing
- Validity
- Reliability
- Trials
- Data Collection

- Analysis of the Data
- Preliminary Conclusions
- Re-Analysis of the Data
- Drafts
- Publish