Go with the Flow
To Facilitate Learning in Laparoscopic Gynecology

Liv Ahlborg
SFOG Varberg
26 aug 2014
Background

- **Traditional surgical training - adverse outcomes**
  
  "To Err Is Human", Institute of Medicine report 1999,

- **Financial and time constraints – inadequate case volumes**

  Williams 2004, Bridges 1999

- **Demand for evidence-based approach and certification**

  Scott 2006, Williams 2007
Aim

To facilitate learning in laparoscopic gynecology
”Tools” in skills training

- Simulator training
- Visuospatial ability
- Self-efficacy
- Flow
- Feedback
Background

- Residents benefit from simulator training
  Larsen 2006, Aggarwal 2006

- Residents improve their surgical results following specific simulator training

- Visuospatial ability determines performance in simulated surgical endoscopy and laparoscopy
Background

- Low **self-efficacy** associated with poor simulator performance and poor academic achievement
  
  *Maschuw 2011, Artino 2010*

- **Flow** motivation↑ results↑
  
  *Csikszentmihalyi 2007, Pain 2007*

- **Feedback** does/does not improve result in simulator or laparoscopic surgery
  
  *Grantcharov 2007, Kruglikova 2010, Snyder 2009*
- Self-efficacy
  Technical skills but lack of belief
  \[\rightarrow\text{results}\]

- Flow
  “Steve Blass disease”
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance

III. To investigate if these non-technical factors and simulator training with or without structured mentorship with feedback influence performance in laparoscopic tubal occlusion
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance

III. To investigate if these non-technical factors and simulator training with or without structured mentorship with feedback influence performance in laparoscopic tubal occlusion

IV. To evaluate the effect of feedback on simulated laparoscopic performance by both quantitative and qualitative methods
Study I

*Visuospatial ability correlates with performance in simulated gynecological laparoscopy*

Mental Rotation test (MRT)
Simulator performance

**Tubal occlusion**

- **Total time**
  - **Seconds**:
    - Easy: ~300
    - Medium: ~200
    - Hard: ~100

**Salpingectomy**

- **Total time**
  - **Seconds**:
    - Easy: ~600
    - Medium: ~400
    - Hard: ~200
Simulator performance
Table 2. Visual-spatial ability measured by MRT-A in relation to gynecological simulation parameters.

<table>
<thead>
<tr>
<th>Tubal occlusion</th>
<th>Easy</th>
<th>MRT-A Medium</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.30</td>
<td>0.31</td>
<td>-0.62</td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.31</td>
<td>0.31</td>
<td>0.57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salpingectomy</th>
<th>Easy</th>
<th>MRT-A Medium</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.61</td>
<td>0.03</td>
<td>-0.64</td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.49</td>
<td>0.09</td>
<td>0.64</td>
</tr>
<tr>
<td>Ovarian diathermy damage (s)</td>
<td>-0.52</td>
<td>0.07</td>
<td>-0.60</td>
</tr>
</tbody>
</table>
Visuospatial ability vs. simulator performance

Table 2. Visual-spatial ability measured by MRT-A in relation to gynecological simulation parameters.

<table>
<thead>
<tr>
<th>Tubal occlusion</th>
<th>Easy</th>
<th>Medium</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.30</td>
<td>0.31</td>
<td>-0.62</td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.31</td>
<td>0.31</td>
<td>0.57</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salpingectomy</th>
<th>Easy</th>
<th>Medium</th>
<th>Hard</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>r</td>
<td>p</td>
<td>r</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.61</td>
<td>0.03</td>
<td>-0.64</td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.49</td>
<td>0.09</td>
<td>0.64</td>
</tr>
<tr>
<td>Ovarian diathermy damage (s)</td>
<td>-0.52</td>
<td>0.07</td>
<td>-0.60</td>
</tr>
</tbody>
</table>
Visuospatial ability vs. simulator performance

Table 2. Visual-spatial ability measured by MRT-A in relation to gynecological simulation parameters.

<table>
<thead>
<tr>
<th>Tubal occlusion</th>
<th>MRT-A</th>
<th></th>
<th></th>
<th>MRT-A</th>
<th></th>
<th></th>
<th>MRT-A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy</td>
<td>Medium</td>
<td>Hard</td>
<td>Easy</td>
<td>Medium</td>
<td>Hard</td>
<td>Easy</td>
<td>Medium</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.30</td>
<td>0.31</td>
<td>-0.62</td>
<td>0.03</td>
<td>-0.57</td>
<td>0.07</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.31</td>
<td>0.31</td>
<td>0.57</td>
<td>0.05</td>
<td>0.46</td>
<td>0.15</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Salpingectomy</th>
<th>MRT-A</th>
<th></th>
<th></th>
<th>MRT-A</th>
<th></th>
<th></th>
<th>MRT-A</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Easy</td>
<td>Medium</td>
<td>Hard</td>
<td>Easy</td>
<td>Medium</td>
<td>Hard</td>
<td>Easy</td>
<td>Medium</td>
</tr>
<tr>
<td>Total time (s)</td>
<td>-0.61</td>
<td>0.03</td>
<td>-0.64</td>
<td>0.02</td>
<td>-0.43</td>
<td>0.17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Score (%)</td>
<td>0.49</td>
<td>0.09</td>
<td>0.64</td>
<td>0.02</td>
<td>0.56</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ovarian diathermy damage (s)</td>
<td>-0.52</td>
<td>0.07</td>
<td>-0.60</td>
<td>0.03</td>
<td>-0.65</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Conclusions

- Visuospatial ability correlates with simulated *gynecological* performance

- Testing the visuospatial ability can be useful in preparation for designing individual training programs
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance

III. To investigate if these non-technical factors and simulator training with or without structured mentorship with feedback influence performance in laparoscopic tubal occlusion

IV. To evaluate the effect of feedback on simulated laparoscopic performance by both quantitative and qualitative methods
Study II

Non-technical factors influence laparoscopic simulator performance among OBGYN residents
Flow correlates with simulator performance

Flow score after simulator training vs. Total session until passed course

$r$: -0.56

$ho$: -0.56
Self-efficacy increases after training

p=0.011
Conclusions

- Non-technical skills are associated with simulated laparoscopic performance among OBGYN residents

- These factors can therefore be used for designing training programs and measuring simulator performance
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance

III. To investigate if these non-technical factors and simulator training with or without structured mentorship with feedback influence performance in laparoscopic tubal occlusion

IV. To evaluate the effect of feedback on simulated laparoscopic performance by both quantitative and qualitative methods
Study III

Simulator training and non-technical factors improve laparoscopic performance among OBGYN residents

Visuospatial ability vs. laparoscopic performance

rho:-0.98
Self-efficacy across groups
Flow score across groups

![Flow score chart showing comparisons between control, trained, and mentor groups across 1st, 2nd, and 3rd operations.](chart)
Laparoscopic performance across groups

- Control
- Trained
- +mentor

Operation duration (sec)

1st 2nd 3rd

* **
Conclusions

- Simulator training compensate for differences in visuospatial ability
Conclusions

- Simulator training compensate for differences in visuospatial ability
- Flow and self-efficacy are enhanced by simulator training
Conclusions

- Simulator training compensate for differences in visuospatial ability
- Flow and self-efficacy are enhanced by simulator training
- Flow, self-efficacy and simulator training improve laparoscopic performance
Conclusions

- Simulator training compensate for differences in visuospatial ability
- Flow and self-efficacy are enhanced by simulator training
- Flow, self-efficacy and simulator training improve laparoscopic performance
- Mentorship with feedback needs to be further explored
Specific aims

I. To evaluate if visuospatial ability correlates with gynecological simulator performance

II. To examine if self-efficacy and flow are associated with simulated laparoscopic performance

III. To investigate if these non-technical factors and simulator training with or without structured mentorship with feedback influence performance in laparoscopic tubal occlusion

IV. To evaluate the effect of feedback on simulated laparoscopic performance by both quantitative and qualitative methods
Study IV

*Evaluation of feedback and learning during simulated laparoscopic training: A mixed methods study*

Simulator performance across groups

![Graph showing the performance of mentors and controls across three simulator sessions.](image)

- **Y-axis**: Right instrument path length (m)
- **X-axis**: Simulator session
- **Legend**:
  - ● Mentor
  - ○ Control

* denotes significant difference between groups.

37
Self-efficacy increases after training
Conclusions

- Feedback improves simulated laparoscopic performance

- Feedback needs to be individualized
An environment that fosters flow and self-efficacy and includes simulator training and feedback will facilitate learning in gynecological laparoscopy and thereby, potentially, patient safety.
TACK!

Liv Ahlborg
Ersta sjukhus
liv.ahlborg@gmail.com
Pek I
Flow experience

The following questions ask about your feelings while using computers in a certain medical simulation. Please describe the last session while using the present simulator by placing check mark on the scale given below

Enjoyment

Interesting  ________________________________  Uninteresting

Fun  ________________________________  Not fun

Exciting  ________________________________  Dull

Enjoyable  ________________________________  Not enjoyable
1. Jag är säker på att jag kan klara de svåraste momenten som uppstår under simulatorövningarna.

☐ ☐ ☐ ☐ ✗ ☐ ☐ ☐ ☐

Inte alls sant

Mycket sant

2. Jag är säker på att jag kommer att kunna förstå innebörden av övningarna.

☐ ☐ ☐ ☐ ☐ ✗ ☐ ☐ ☐

Inte alls sant

Mycket sant
Visuospatial ability results

Fig. 1.
Pek 2
28 OBGYN residents complete MRT-A and Self-efficacy

Conduct basic simulator set

Self-efficacy and flow are completed

19 of the OBGYN residents perform simulator training (until reaching pre-evaluated credential level)
<table>
<thead>
<tr>
<th>Simulator performance</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$r$</td>
</tr>
<tr>
<td>Lifting and grasping</td>
<td></td>
</tr>
<tr>
<td>Right instrument angular path length (°)</td>
<td>−0.43</td>
</tr>
<tr>
<td>Left instrument angular path length (°)</td>
<td>−0.45</td>
</tr>
<tr>
<td>Right instrument path length (m)</td>
<td>−0.40</td>
</tr>
<tr>
<td>Left instrument path length (m)</td>
<td>−0.42</td>
</tr>
</tbody>
</table>
### Table 2  Correlations between simulator performance, self-efficacy, and flow

<table>
<thead>
<tr>
<th>Simulator performance after training</th>
<th>Self-efficacy before</th>
<th>Self-efficacy after</th>
<th>Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$r$</td>
<td>$p$ value</td>
<td>$r$</td>
</tr>
<tr>
<td>Sessions of lifting and grasping until passed course</td>
<td>-0.40</td>
<td>0.089</td>
<td>-0.61</td>
</tr>
<tr>
<td>Total sessions until passed course</td>
<td>-0.56</td>
<td>0.013</td>
<td>-0.74</td>
</tr>
</tbody>
</table>

Self-efficacy was assessed before and after the 2-day simulator course. Flow was assessed after the 2-day simulator course.
Pek 3
28 residents
Randomized
Baseline operation
Visuospatial ability, Self-efficacy, Flow

Group 1
Control group

Group 2+3 Simulator training with or without mentorship

3 tubal occlusions performed
Self-efficacy before and after
Flow after

Outcomes:
Flow, Self-efficacy, Visuospatial ability
Duration of surgery
Flow correlates with laparoscopic performance

rho: -0.59
Flow vs. laparoscopic performance

![Graph showing the relationship between flow enjoy and concentration score and surgery duration.](image)
Feedback för handledare och ST-läkare i grupp 3 steriliseringsstudien

Ifylles av handledaren tillsammans med ST-läkaren direkt efter operationen och skickas med DVD:n

Svara kortfattat

Beräknad tidsåtgång 5 min

Gick operationen enligt planering?

☐ Ja ☐ Nej

Fanns det försvårande omständigheter?

☐ Ja ☐ Nej

I så fall vilka?

Vilka moment gick bra?

Vilka moment gick mindre bra?

Vad kan förbättras till nästa gång?

Vi har gått igenom feedback efter operation nr_____

Ort_________________________________ Datum____________________

Handledare                      ST-läkare
Checklista för handledare och ST-läkare i grupp 3 steriliseringsstudien
ifylles av handledare tillsammans med ST-läkare inför operationen
och inskickas tillsammans med DVD:n

Patientgenomgång
Älder?
Sjukdomar?
Tidigare opererad i buken?
Ökad risk för komplikation?
Indikation?

Stapel
Gas, flöde, tryck
Kamera, skärpa
Ljuskabel, ljusstyrka
Diatermi

Portsättning
Rekommenderad portsättning: öppen teknik? Verres?
Var går vi in?
5 mm/ 10 mm optik?
Risker vid portsättning

Anatomi
Vilka strukturer ska identifieras under operation?
Uterus
Tubor
Ovarier
Lig Ovarium Proprium
Lig Infundibulum Pelvicum
Lig Rotundum
Lig Sakrouterma
Plica vesicouterina
Fossa Douglasi

Tillvägagångssätt
Tappa blåsa/ KAD/ Pat tömt blåsa
Sätt Hulkatäng
Kontrollera stapel
Sätt kameraport/Verres kanyl
Insufflera gas
Tippa patienten
Inspektera buken
Sätt arbetsstrokar
Peta undan tarmen
Hulka uterus
Inspektera lilla bäcken, identifiera ovan nämnda strukturer
Diatermiera tubor
Klippt tubor
Inspektera hämostas
Ta ut arbetsstrokar under inspektion
Exsufflera gasen

Vi har gått igenom checklisten inför operation nr______

Namn Efternamn

Ort
Datum
Baseline simulator performance Paper III
Baseline operation Paper III

Duration of Surgery (s)

Controls  Trained  +Mentor
Pek 4
16 medical students randomized

8 students receive structured mentorship during
3 simulated salpingectomies
Self-efficacy assessed before and after simulator training
Flow assessed after
Group interview conducted after

8 students conduct
3 simulated salpingectomies without mentor
Self-efficacy assessed before and after simulator training
Flow assessed after
Group interview conducted after

Outcomes:
Simulator performance
Students opinions on mentorship and learning
## Focus group results

<table>
<thead>
<tr>
<th>Themes</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Feedback/Mentor</strong></td>
<td><strong>Mentor group</strong></td>
</tr>
<tr>
<td></td>
<td>Result improving every time</td>
</tr>
<tr>
<td></td>
<td>Supportive, Passive</td>
</tr>
<tr>
<td></td>
<td>Pressure to do well</td>
</tr>
<tr>
<td><strong>Learning</strong></td>
<td>Understanding the procedure</td>
</tr>
<tr>
<td>Experience/Simulator</td>
<td>Concentrated</td>
</tr>
<tr>
<td></td>
<td>Want to succeed and be acknowledged</td>
</tr>
<tr>
<td></td>
<td>Authentic</td>
</tr>
<tr>
<td></td>
<td>Pressure to save the patient</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Baseline simulator performance Paper IV

Right instrument path length (m)

Mentor  Control
Self-efficacy

Knowledge/Skills

Performance

Persistence
Self-efficacy Item 3

Score

Before       After

* male

female
Flow across groups

Flow score

Residents

Students
Self-efficacy

Knowledge/Skills

Performance

Persistence
Anxiety

Flow (concentration, enjoyment)

Boredom