**Abstract**

The Flight Physics Concept Inventory (FliP-Coln) provides feedback to high school and college students on introductory physics as well as their educators about common (mis)concepts in fluid dynamics in the context of aviation. Currently, FliP-Coln is in development in two languages (German and English). With this poster the authors wish to facilitate collaborative discourse with concept inventory designers as well as language experts. Due to more focus groups and think-aloud interviews, many improvements were implemented. The online-based implementation was recently tested in the English language version.

---

**Challenges Partially Solved**

- Finding big test populations for validation of the instrument
- Reconciling the different models of lift (items' independence!)
- Positioning of frustrating drop-out questions

**Challenges**

- Curricular challenges (war history of Germany, US science standards)
- Pictures provoking misconceptions

---

**Example of Important Change:**

**Question (adapted)**: In the following sketch, which arrow indicates best the direction of aerodynamic lift?

- correct: A
- incorrect: B
- correct: D
- incorrect: C
- marked: C
- blank: E

---

**Surprising Descriptive Results**

**Question** (adapted): In the following sketch, which arrow indicates best the direction of aerodynamic lift? Flight hours Answer Freq. of resp.

<table>
<thead>
<tr>
<th>Flight hours</th>
<th>Answer</th>
<th>Freq. of resp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>altitude increases</td>
<td>28</td>
</tr>
<tr>
<td>&gt;0</td>
<td>altitude increases</td>
<td>36</td>
</tr>
<tr>
<td>&gt;20</td>
<td>speed increases</td>
<td>58</td>
</tr>
<tr>
<td>&gt;1000</td>
<td>speed increases</td>
<td>28</td>
</tr>
<tr>
<td>n=218</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

From the N=1135 aviation students and 21 flight instructors (n=270) replied, n=130 filled the 30min survey complete. Many of the 70 inventory questions revealed interesting results. Especially applying the, mostly known, definition of lift and drag to give questions seems to be a problem – even for advanced students. Further, cause and effect are often not clearly distinguished and result in wrong or inconsistent answer patterns. Moreover, aviation students with 0.7 to 999 flight hours seem to behave different than students with 0 or 1000+ flight hours when predicting flight behavior.

---

**Discussion**

**Surprising Results**: Some of the incorrect answer patterns of aviation students concerning the application of the lift definition seem to be consistent with a “Lift always points up” concept. However, most answer patterns are very inconsistent and even contradicting (see QID14, 17 & 18). This seems to indicate that often there is no solid concept of aerodynamic lift yet! Similar can be said for the concepts of drag and thrust – only less drastically pronounced. The question remaining, why students with zero and those with 1000+ flight hours answer similar (see QID032), needs further investigation and might hold interesting results for further improving the inventory.

---

**Current Challenges**: Finding educational institutes with a big and diverse student body to further test FliP-Coln, has proven difficult. The challenge of a concurrent bilingual development of the instrument in English and German turned out to be surprisingly fruitful for eliciting differences in learning culture and linguistic vagueness but it is a constant challenge to iterate items that remain (A) easy to understand, (B) are phrased scientifically correct and (C) are not misleading.

**Next Challenges**

1. Finding experts in PER and language sciences.
2. Finding educators to field test with big N and C population.

---

**Literature**