Abstract
The new Flight Physics Concept Inventory (FiP-Coln) provides feedback to educators and students in introductory physics or aviation science. It elicits common misconceptions in fluid dynamics in the context of aviation. FiP-Coln was developed in two languages and two cultures. The internal reliability analyses resulted in α Cronbach = 0.76 (German) and α = 0.81 (English version). The bilingual development and item analysis yielded many insights for differences in the use of physics language as well as national teaching cultures.

Surprising Results
Initially, a sailplane (glider) is in steady gliding flight (losing altitude but maintaining relative airspeed). What changes when the center of mass (magically) shifts a little bit forwards and the sailplane, then, reaches a constant speed again?
- Aerodynamic lift: O is increased O is decreased O stays constant
- Aerodynamic drag: O is increased O is decreased O stays constant
- Weight: O is increased O is decreased O stays constant
Many top-scoring German engineering students (N=135) answered with “increased” to the third sub question of question 027e (weight...). This was scored wrong and resulted in a negative “corrected item-total correlation” (CITC) for this sub question. Strictly speaking, they are correct, since the sailplane loses altitude in the scenario and weight is the force due to gravity. Surprisingly, the English sample of aviation students (N=123) did have a positive CITC. This suggests that the later student group did not distinguish between weight and mass as much as the German group. Here are some hypotheses for discussion:
- The German engineering assessment culture puts more emphasis on small effects.
- The English aviation teaching culture rewards students who ignore small effects.
- In German the difference between “weight” and “mass” may be more distinct.

Motivation
- Climate change is hugely driven by the transportation industry.
- In a world that is ever more dependent on the increasing efficiency of transporting goods, it is imperative to develop...

Concept or misconception?
“Aerodynamic lift points upwards”
This is only true for horizontal flight. In this picture it even points downwards. Our data shows that many students cannot apply this definition, even though they can recite the correct definition of lift

“Aerodynamic objects are pointy in the front!”
The opposite is true! First and foremost, you want to avoid turbulence in the back.

“Increasing thrust, increases speed!”
For most general aviation planes (like Cessna) increasing thrust means increasing altitude!

Summary & Outlook
The Flight Physics Concept Inventory in its current state turns out to be a reliable and validated tool for analyzing one’s own learning intervention in the context of flight physics. Surprisingly, it also turned out as a magnifier for differences in learning or testing culture. The validation process also showed that misconceptions are still widespread among German and English engineering and aviation students. Even flight instructors score below 72%.

Outlook: In the future we will implement an automated scoring and test result tool for educators to analyze their PRE and POST tests. Another milestone to be reached is setting up a database where educators can upload anonymized test results and compare them with others to facilitate discourse and improve research-based teaching.

Next steps:
- Finding educators to field test with big N and Y population.
- Translating and revalidating FiP-Coln in more (sub) cultures.
- An automated feedback tool for educators.
- Online database for comparing results and further research.

Translation Issues
Q36 A) 5% B) 74% C) 12% D) 9% English vers. German vers.

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