A Scalable Online Platform for Evaluating and Training Engineering Students’ Visuospatial Skills

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Intro

**Visuospatial skill** the capacity to understand, reason and remember the spatial relations among objects or space.
Intro

Students’ visuospatial skills are important for:

- Learning
- Future performance
- Retention rates
- Career choices in the STEM field.

(Lubinski, 2010; Veurink, and Hamlin, 2011; Veurink, & Sorby, 2012)
Intro

Researchers and instructors have put a lot of effort into evaluating and training students’ visuospatial skills.
However

Previous methods often rely on

- Traditional paper-based evaluation method
- Face-to-face workshop

which are **time-consuming** and **costly** especially for **large** classes.
Online Platform

Our online platform is designed to offer

• a comprehensive assessment of visuospatial skills with multiple choice questions and free-hand sketching
• exercises that help students to acquire strategies to more effectively perform visuospatial problem-solving

on a large scale.
Features

- Automatic grading
  - Intermediate Feedback
- Data management
  - Nation-wide database
- Fine-grained behavior data collection
  - Student’s problem solving strategy
- Student’s performance tracking
  - Individualized learning
Workshop

The content of the online workshop was adopted Sorby’s (2011) “Developing Spatial Thinking”.
Platform Demo

Demo
Platform Evaluation

Pre course PSVTR test → Course → Workshop (Through the Platform) → Post course PSVTR test
Participants

Pre-test Participants

Total of 624 students from AE199 (Computer-Aided Design), GE101 (Engineering Graphics & Design), TAM 210 (Intro to Statics) and TAM 211 (Statics) used our platform to conduct the PSVTR test at the beginning of the semester.
Workshop Participants

We recruited 30 students (PSVT:R score M=21.3) from GE101 and AE199 to participate in our workshop. Total of 17 students completed all the tasks.
Result

$t = 2.35, p = .03.$
Result

Comparison of improvement between students in the workshop and students not in the workshop

$t = 2.418, p = .02.$
Result

Comparison of improvement between students with low pre-test score and students with high pre-test score

$t = -2.017, p = .08$. 

Graph showing the comparison of improvement between high-pretest and low-pretest students.
Interview Result

Students normally spent 38 min on the exercise each week.

88% Students like the flexibility of the online platform.

- They often took the task after 7:00 pm or during the weekend.
Conclusion

The preliminary study shows that online platform can effectively evaluate the visuospatial skills in a large scale and train the visuospatial skills with very low cost.
Future plan

• Automatic grading on free-hand sketching problems
• Error pattern analysis
• Individualized hints / training
• Apply to a larger scale (e.g. incoming freshman)
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