# Associations between Secondary School Students' Spatial Skills and Teacher Perceptions of CS Engagement and Aptitude

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## CCS CONCEPTS

• **Social and professional topics → K-12 education**.

## KEYWORDS

secondary school, middle school, spatial skills, teacher, perception, aptitude

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## 1 INTRODUCTION

Spatial skills in CS have been explored fairly extensively at a university level [1, 2, 4–13], but little work has been done at other levels [3]. This poster will present some initial work conducted with secondary school students using student spatial skill test scores and teacher-reported measures of engagement and aptitude in CS classes.

## 2 DATA COLLECTION

An advert was put out to a national list of S2[1] computing teachers in Scotland to take part in a study during class time. Three teachers responded who collected – after acquiring parent and student consent – data from 118 students. Students took take a spatial skills test (the Revised Purdue Spatial Visualisation Test of Rotations [15], or PSVT:R, see figure 1) and self-reported their gender[2]. Teachers supplied a measure of perceived student engagement and student aptitude on a 5-point likert scale for each participating student (where 1 indicated "low [aptitude|engagement]" and 5 indicated "high [aptitude|engagement]" without explicit labels on likert points in between). The specific prompt teachers were given was: "In their computing classes, this student typically/on average demonstrates:" followed by the options for both aptitude and engagement.

[1]S2=second year of secondary school, aged 12-14
[2]Using options proposed by Spiel et al. [14]

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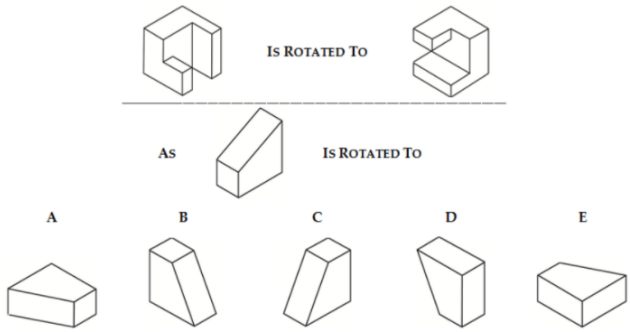
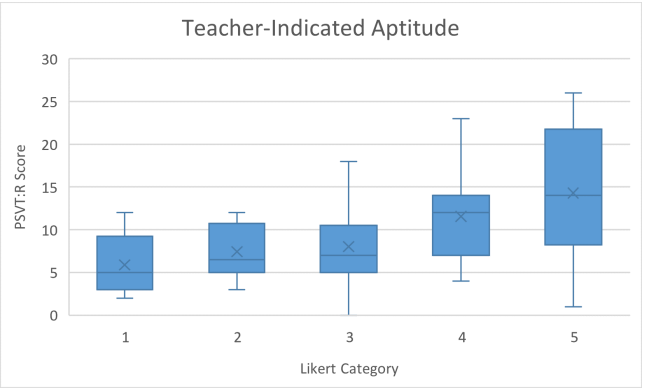


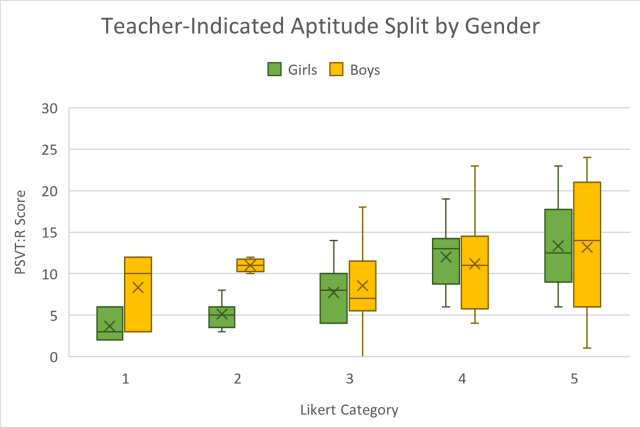

**Figure 1: Sample item from the Revised PSVT:R; the correct answer is B**

## 3 FINDINGS

Students' spatial skills scores were grouped by teacher-reported aptitude and were examined with an ANOVA. Those who were reported as having higher CS aptitude had better spatial skills on average, and the difference between groups was statistically significant. The same can be seen with teacher-reported engagement.

Separate ANOVAs were conducted in the same fashion, this time separated by gender. The spatial skills of the girls were statistically significantly different in each teacher-indicated aptitude category, whereas boys showed no significant differences in spatial skills between categories. Again, these differences were replicated in engagement measures.






## 4 DISCUSSION POINTS AND POSSIBLE FUTURE WORK

It was found that overall there was a relationship between student success (as gauged by teachers) and their spatial skills, though when splitting by gender this only held for girls. In other words, boys do not need to have high spatial skills to be perceived as being engaged and having high aptitude, whereas girls do. Without more careful data collection it is hard to establish *why*, but the authors wish to bring this to the computing education community to discuss possibilities to ensure that the next steps are carried out with many possible outcomes in mind.

There are some issues with using likerts to gauge teacher perceptions, since without concrete criteria to look for, different teachers may have different internal indicators of "high engagement" or "low engagement". Furthermore, there are only small differences between aptitude and engagement indicators given by teachers. Teachers recorded the same scores for aptitude and engagement for more than a third of the students, with differences predictably not being significant in a paired t-test. This suggests that either these two measures are very closely linked or that teachers do not tend to differentiate between them.

There are several avenues for possible future work which would be valuable to discuss with the ICER community:

- Student-reported measures to compare against spatial skills and teacher indications
- Aptitude as measured by assessments or tests for a more "true" indication
- Qualitative exploration of student strategies related to spatial skills and teacher perspectives on aptitude and engagement

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