

# To R or to SPSS: Does autonomous choice of learning technology affect competency & anxiety in Psychology undergraduates?

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## Background

- Statistics are a required element of accredited psychology undergraduate programmes but are rated as the module students are most anxious about, in turn leading to increased negative views about their degree course.
- @UofGPsychology students are taught to use SPSS in Levels 1 & 2. Level 3 students are given the option of using SPSS or R. The course is supported via lectures, online materials & forums.
- SPSS has advantage of pull-down menus and is straightforward to use. However, requires limited understanding, leading to high variability in overall ability & interpretation of statistics.
- R requires development of programming language and skills, and can be difficult to grasp at first; however, it's shown to increase graduate attributes and attractiveness to employers (DICE 2014).
- Participants:** 131 Level 3 Psychology students; 85 students opted to use R (65%); 46 students opted to use SPSS (35%).
- Aim:** to establish if having the autonomy to choose own means of learning statistics impacts on competency and anxiety.

## Methods

### Quantitative

- Analysis of anxiety via Statistics Anxiety Rating Scale (STARS) (Hanna et al., 2008) at two time points (November; March); Analysis of overall class exam performance; Analysis of data-wrangling ability via homework exercise

### Qualitative

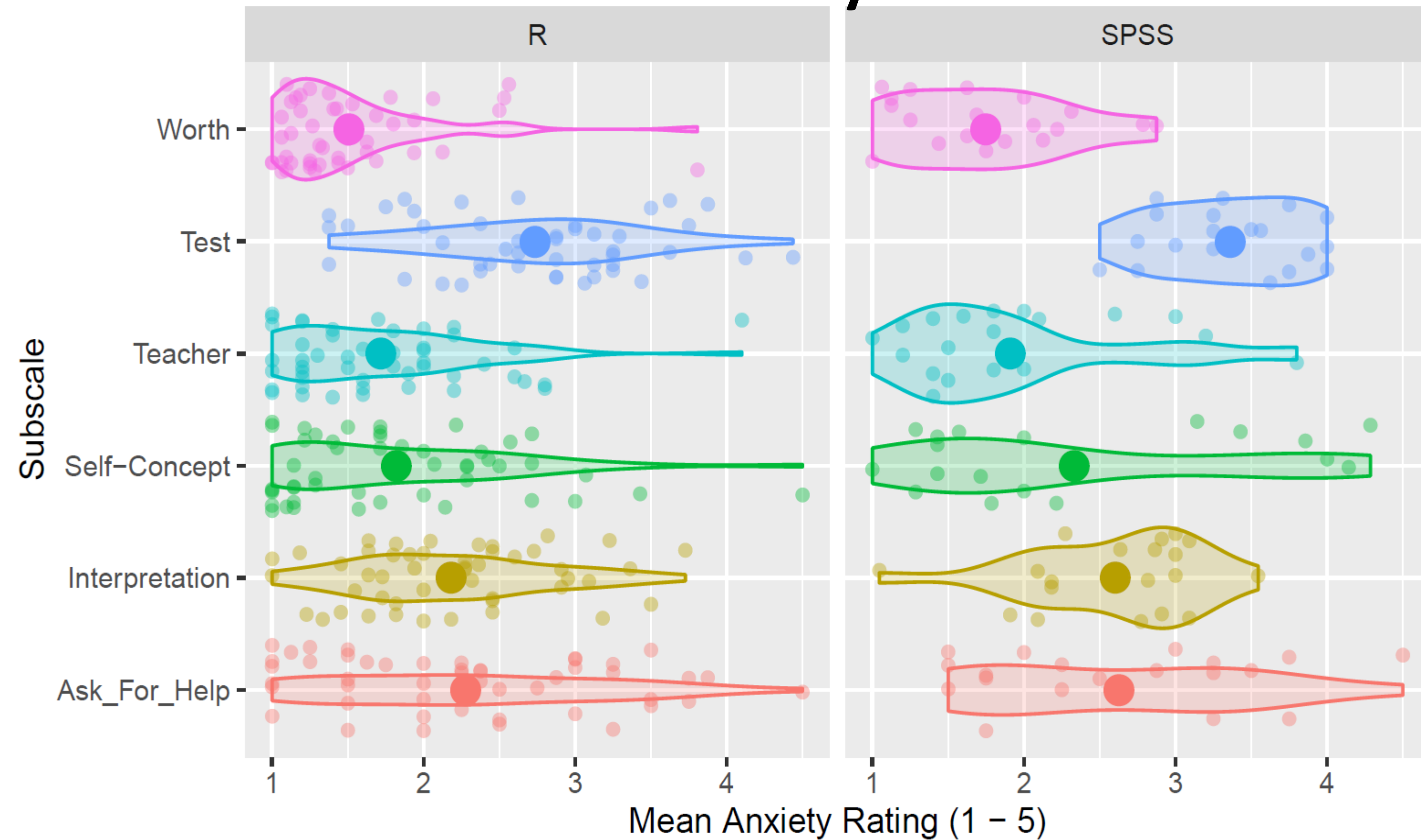
- Analysis based on end-of-term course evaluation system (Evasys) and anonymous online comments throughout term

## Conclusions

- Levels of anxiety (test-related) are lower, whilst overall competency is higher, in students who chose to use R.
- Students found weekly homework valuable, irrespective of software, and expressed increased confidence in ability after initial fears of learning open source coding.
- Overall, freedom to choose learning software may not reduce anxiety, as potentially anxious students opt for perceived easier option. Instead, anxiety is reduced by increased confidence via a deeper understanding of analysis through open source coding via R.

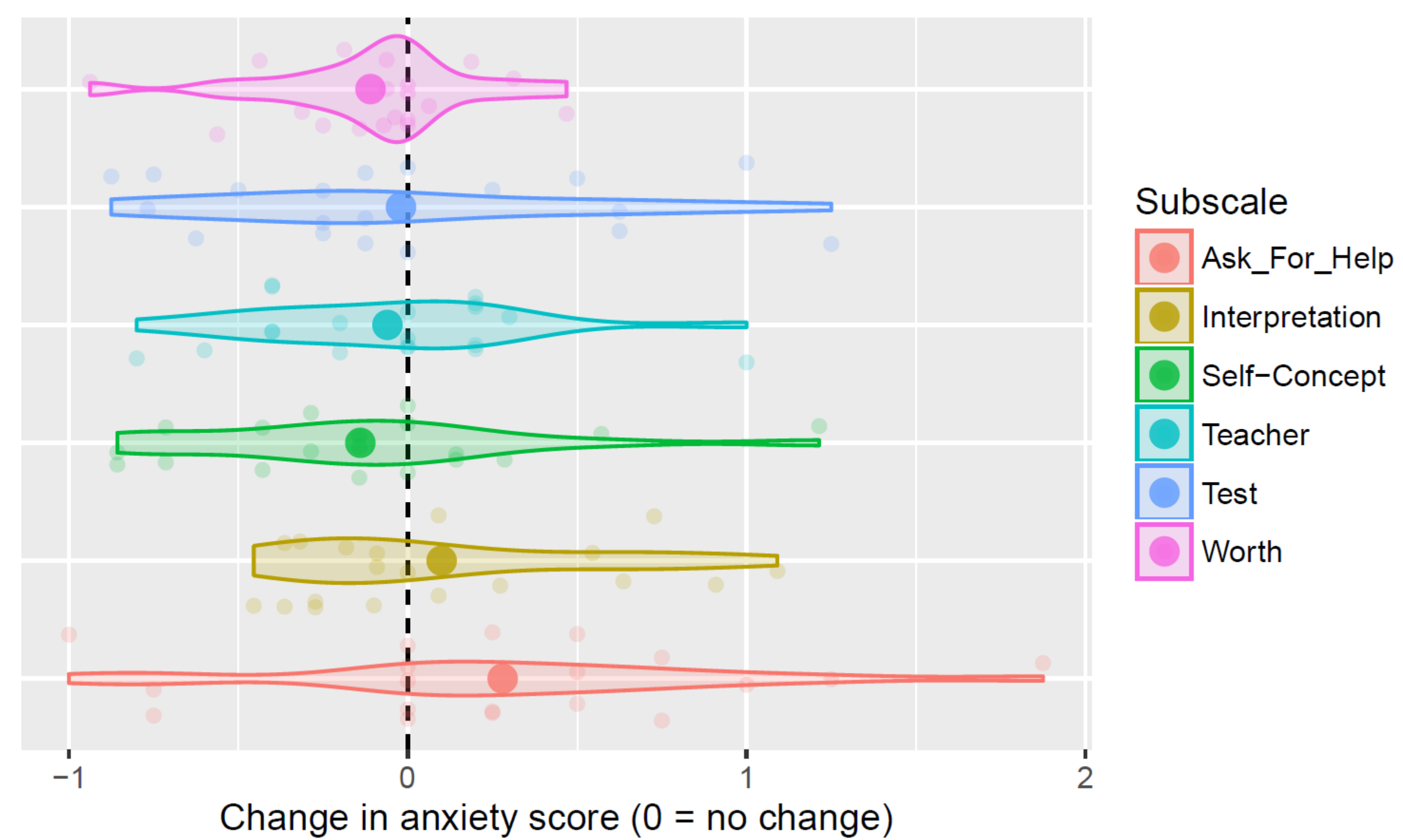
## Analysis

### STARS Subscales by software choice



- All subscale means higher for SPSS users. Test-related anxiety was significantly higher in SPSS users, after Bonferroni correction, ( $p < .0083$ ).
- Overall Anxiety (not shown) significantly higher in SPSS group ( $M = 2.35$ ) than in R group ( $M = 1.97$ ),  $p = .005$

### Change in anxiety via STARS



- Change in anxiety based on 19 R users at two time points showed no significant differences: 4 subscales showed mean decrease; 2 showed mean increase.

## Qualitative Analysis

### Importance of Active rather than Passive Engagement

"We learned the background and theory behind the tests that we run, rather than blindly pressing buttons in a Lab.."

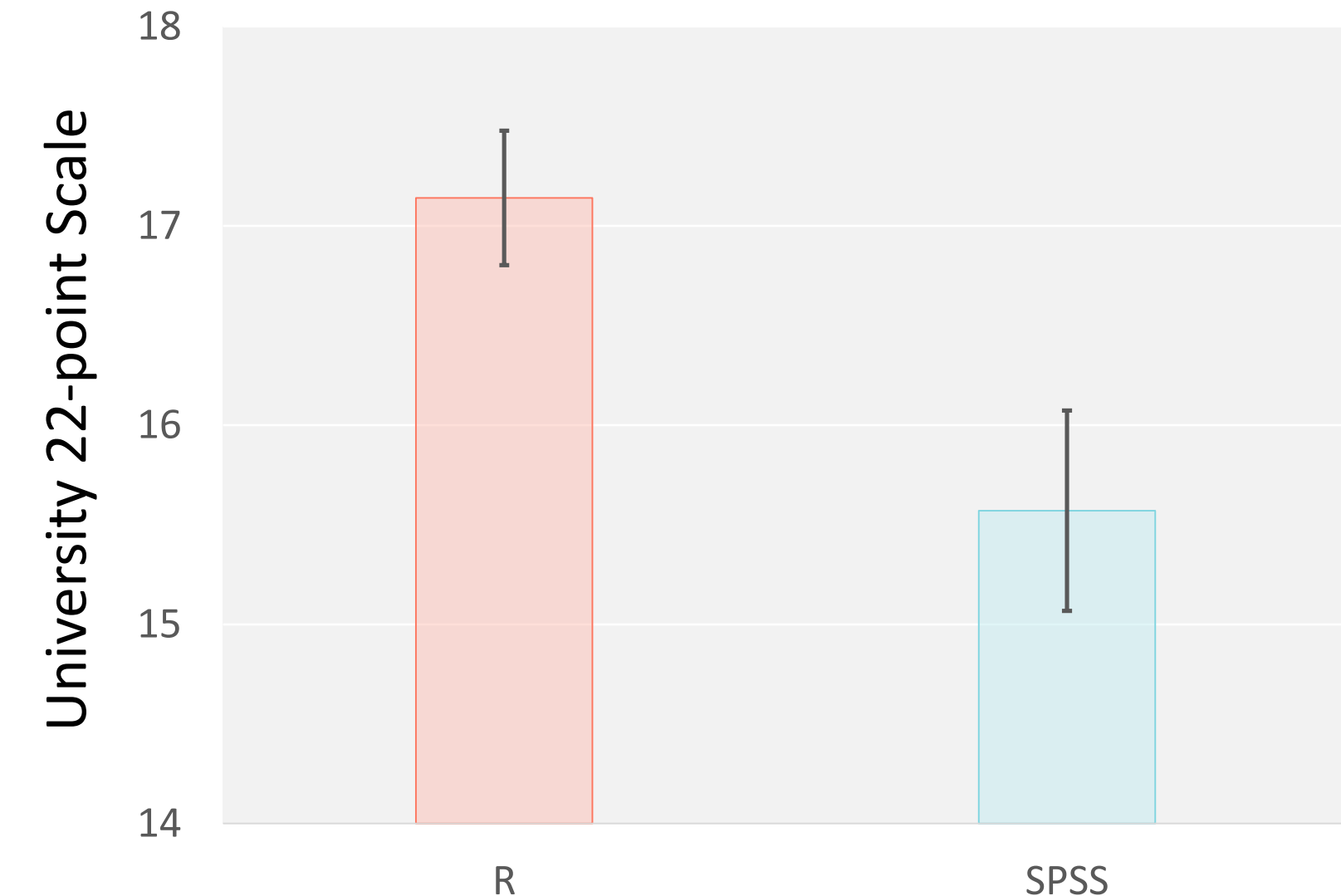
"Additionally, by having to hand in the homework every week we actually have to spend time thinking about the material and really get to properly understand it, instead of trying to cram everything 2 days before the exam."

"...what was most helpful was having to figure things out ourselves for the homework. ....there was no step by step guide...., which really helped keep the information in my head. Having the homework count towards my grade forced me to take it seriously and has taken a fair amount of stress off of the exam."

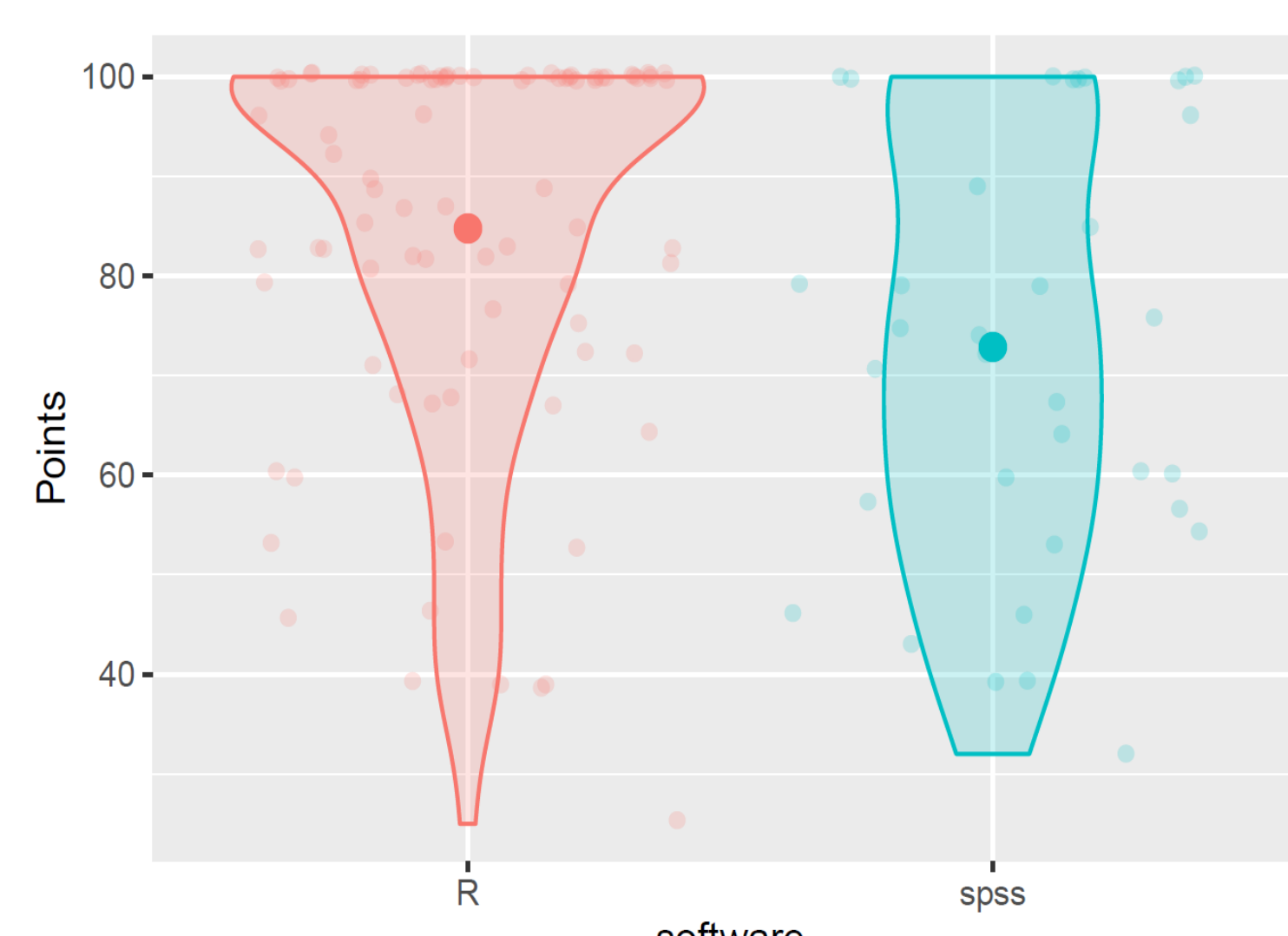
"....R.....Seems a lot more flexible and a lot more transparent, which is good when you're just becoming acquainted with the underlying concepts...At first I was a little scared of it.... but it's not too difficult a language to get to used to."

"You have turned me from kind of hating stats to actually enjoying it"

### Overall Class Performance



### Homework Performance



- Overall performance significantly higher in R group than SPSS group,  $p = .011$
- Homework performance significantly higher in R group than SPSS group,  $p = .006$ . Difference remained after controlling for student performance on other assignments not related to data-wrangling.



## **To R or to SPSS: Does autonomous choice of learning technology affect competency & anxiety in Psychology undergraduates?**

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Statistics modules are commonplace on university programmes, both undergraduate and postgraduate, with often a proven level of competence being a mandatory requirement in order to advance within the degree – particularly in Psychology and Social Sciences (Chew & Dillon, 2014; Gould, 2010). However, a number of studies have found that when asked, students rate themselves as more anxious about statistics than any other module, potentially leading to negative attitudes towards not only statistics but towards their degree and their own general abilities. At Glasgow, L3 Psychology students are encouraged to co-create their engagement with learning technology by choosing between utilising one of two software packages for statistics: a) SPSS – a point-and-click programme with rich Graphical User Interface (GUI) environment; the traditional industry norm; taught in L1 and L2; or b) R – a text-input programme with sparse GUI environment; showing a growing presence in the discipline; introduced at L3. SPSS has the advantage of pull-down menus making it straight-forward to use, though it requires no understanding of the computation performed meaning students often have variable understanding of the processes involved and problems interpreting the output. R in contrast requires students to develop a knowledge of coding and functions and is fast becoming the preferred software by researchers; knowledge of R has been shown to enhance graduate attributes and attractiveness to employers leading to increased earnings post-degree (DICE Tech Salary Survey, 2014). Thus, to compare the effect of self-selection of software, and in turn self-directed learning in statistics, we will use the Statistics Anxiety Rating Scale (STARS) (Hanna et al, 2008), as well as a series of open ended qualitative questions and student grades achieved, to explore the above issues with our Psychology students, establishing if having the autonomy to choose impacts on perceived and actual competency, and on statistics anxiety in general.

### **References**

Chew, P. K. & Dillon, D. B. (2014). Statistics Anxiety Update: Refining the Construct and Recommendations for a New Research Agenda. *Perspectives on Psychological Science*, 9(2), 196-208

Gould, R. (2010). Statistics and the modern student. *International Statistical Review*, 78, 297–315.

Hanna D., Shevlin M. & Dempster M. (2008). Structure of the statistics anxiety rating scale: a confirmatory factor analysis using UK psychology students. *Personality & Individual Differences*. 45, 68–74.