

From passive to active learning: enhancing statistics education with KitaaSTAT

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Abstract

Many challenges affecting statistics instruction stem from the choice of statistical software, as many of the software programs used for teaching statistics were originally designed for proficient users to conduct advanced analyses (Abbasnasab Sardareh, 2021). This review examines the use of the KitaaSTAT software in teaching a core quantitative research methods module at the postgraduate level. My observations of student interactions with the software during the module point to the ease of use and built-in interpretations of results as the key strengths of the software.

Introduction

Statistical or math anxiety may be described as feelings of apprehension or fear that a person experiences when conducting statistics or math-related tasks. Aversion to statistics is common among university students (Bjälkebring, 2019). As most statistics courses emphasise proficiency in statistical software and often require students to master coding syntax within a limited timeframe, learners may experience statistical anxiety. Instructors need to differentiate between knowledge of the software and knowledge of statistics (Timothy, 2005).

This review focuses on the KitaaSTAT software¹, a web-based platform that allows users to upload their data and run statistical tests without any knowledge of coding syntax, with results and explanations provided instantly. The current version of the software includes the following tests: chi-squared, t-tests (one sample and independent samples), correlation analysis, simple and multiple regressions. To become familiar with the software, users also have the option to use the built-in dataset for their analysis.

By allowing students to upload and analyse primary data, the KitaaSTAT software promotes project-based learning by engaging students through real-world problem-solving (Kovacs *et al.*, 2019). Grounded in the cognitive constructivism learning style, it integrates metacognitive scaffolding via the pop-up alerts within the tool, which highlight results that need to be explored further, encouraging students to reflect critically on their analyses at each stage. Additionally, the prompt outputs and tooltip feature, which provide instant interpretations of results, align with the principle of immediate feedback, supporting learning by resolving doubts and reinforcing understanding in real time (Marson, 2007, Hadijah *et al.*, 2022).

¹ www.kitaa.org

The streamlined design of the software is intended to minimise cognitive load by presenting only the key statistical tests covered in the module, allowing both students and teachers to concentrate on a singular method of analysis at a time (Sweller *et al.*, 2019).

Application

In a compulsory quantitative research module for postgraduate taught students, students used the built-in dataset to practise the independent samples t-test by assessing whether there were differences in the average incomes of men and women. Figure 1 below shows the software interface which features the statistical test options on the left. To run the independent samples t-test, the student clicks on the fourth tab which leads to the page in the image. The student then selects a variable of interest (in this case, income) and a grouping variable (gender) by ticking the box next to the variable name. The results from this analysis are displayed below, with a tooltip appearing to explain what the numbers mean when the cursor hovers on the results.

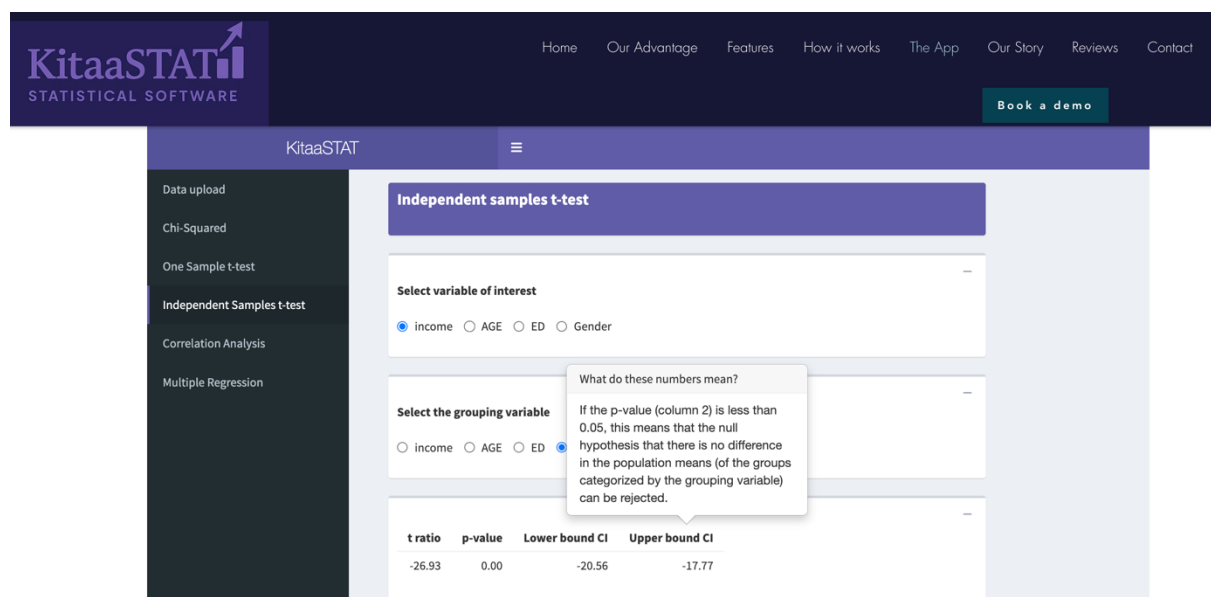


Figure 1. KitaaSTAT interface for independent samples t-test

In figure 2 below, students proceed to use the 'Ordinary Least Square' (OLS) model to run a simple regression of gender on income. The results from this analysis are displayed below and, in addition to the tooltip which explains the results, a pop-up alert also appears to flag that the R-squared which determines the fit of the model is less than 50%.

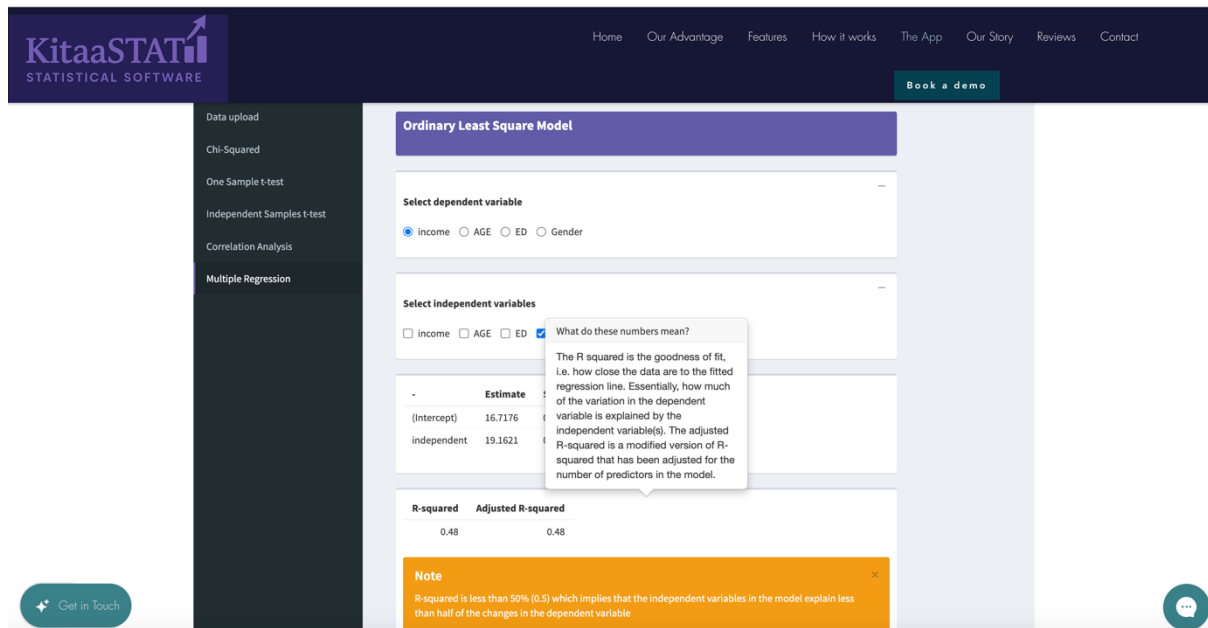


Figure 2. KitaaSTAT interface for Ordinary Least Square simple regression analysis

Reflections

While delivering the module, I observed that many students would often refer to the tooltips as a guide or to reinforce their initial thoughts about what decisions to make on the basis of the results provided (for instance, when deciding whether to reject the null hypothesis following a t-test). In many instances, this encouraged students to carry on with independent problem-solving rather than immediately asking for support. Students who had initially been hesitant to engage in statistical analysis appeared to become more active during the in-class exercises, following the prompts within the software and participating in discussions within their groups. In comparison to the alternative software used, students using KitaaSTAT seemed to progress through their analyses more quickly and confidently, probably because the simple interface made it easy to identify and apply the appropriate statistical tests.

These observations suggest that students may be more likely to engage in statistical analysis if the software is user-friendly, which could help to demystify statistical analysis and address self-efficacy issues stemming from negative attitudes toward statistics (Breneiser, Rodefer and Tost, 2018).

Other statistical software

Abbasnasab Sardareh (2021) and Shepherd and Richardson (2024) provide comprehensive comparisons of the most widely used statistical software in educational settings: R studio, R Commander, SPSS, JASP and Jamovi. That these software programs are all downloadable and generate high-quality data visualisations accounts for their widespread adoption for teaching statistics.

RStudio has the advantage of being open source, though beginners may be discouraged from attempting the steep learning curve its reliance on coding syntax demands. For users who prefer a menu-driven interface, R Commander provides a point-and-click alternative. SPSS is a popular option across several institutions, owing to its intuitive menu-driven interface that allows users to run statistical tests without coding syntax. However, its high cost and institutional license requirement may pose challenges for student access. JASP ('Jeffrey's Amazing Statistics Program'), developed in 2013, features a user-friendly point-and-click interface which provides real-time output. It is also supported by several learning resources such as instructional videos and documentation. Similarly, Jamovi, developed by former JASP contributors in 2016, also offers real-time output in a point-and-click environment.

One drawback of point-and-click systems is the need to remember where specific statistical tests are located, which can increase student cognitive load, especially in platforms like SPSS which feature a vast array of functions. It may also result in students' guessing instead of carefully thinking through which command to use in specific situations (Chance *et al.*, 2007). Also, when using software like SPSS, STATA or RStudio, students will need to re-run their analyses every time they need to make small changes, such as adding or removing a variable from an analysis. This limitation is addressed in JASP and Jamovi, where real time outputs allow for fluid modifications.

Conclusion

The KitaaSTAT software has the potential to reduce statistical anxiety via its unique features (tooltips and pop-up alerts) which stimulate a gradual understanding of various statistical outputs. However, it is not without limitations. Being web-based, it requires a stable internet connection for access. Also, it does not currently include the graphical visualisations preferred by visual learners (Bromage *et al.*, 2021) and its limited range of statistical tests could restrict more advanced users. Additional features such as a wider selection of built-in datasets would also enhance its usefulness for practice.

While my observations of student interactions with the software indicated that KitaaSTAT was helpful for data analysis and interpretation, I was unable to report on direct measures of statistical anxiety. Future evaluations could address this by administering a survey to student users that incorporates the affective dimension of the 'Survey of Attitudes Toward Statistics', a validated tool for measuring emotional responses to statistics developed by Schau (1995).

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