Rasch Measurement in Language Education Part 4:

Rasch Analysis Software Programs

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In the previous 3 installments of this series, I presented an overview of Rasch measurement theory, comparing it with Classical True Score and Item Response Theory, and tried to elucidate the differences between various Rasch models. In future installments, I intend to examine ways in which Rasch measurement Theory can be applied to specific measurement situations encountered in language teaching.

Many readers have requested information about recommended Rash software programs. In this installment, I will review the five most widely used Rasch analysis programs along with information about how to obtain them or get further information.

Winsteps

For analyses employing the Rasch dichotomous, rating scale, and partial credit models, the most widely used software is most probably Winsteps (Linacre, 2009). Winsteps was originally developed by Benjamin Wright and John Michael Linacre at the University of Chicago in the 1980s (Linacre, 2004). Although it has gone through numerous updates and name changes, the programmers have managed to maintain backward compatibility with all previous versions.

To conduct a Rasch analysis using Winsteps, the user must first create a control file that specifies the model parameters, data structure, and output format using a special Winsteps control language. This control file is saved as a text file and then run from the Winsteps program. The data to be analyzed can either be appended to the end of the control file, or stored in an Excel file that is addressed in the control file. Because the control file syntax can be intimidating to non-programmers, a graphical control file set-up module has now been added to Winsteps. This allows users to set up their analyses in a more familiar graphical fashion, by selecting radial buttons and filling in labeled text fields.

In addition to the standard Rasch variable maps, person and item measures, and fit statistics, Winsteps also provides many advanced analytical features, such as distractor analysis, principal component analysis of the Rasch residuals for assessing unidimensionality, and analysis of differential item functioning. In fact, the full-version can report over 30 types of tables, files, plots and graphs. The full version of Winsteps currently costs US $149. A free version called Ministep is also available that has all features, but is limited to 25 items and 75 persons.

For a novice who merely wants to get a taste of Rasch analysis, however, it is hard to beat the restricted version of Winsteps that is included with a purchase of Applying the Rasch Model (Bond & Fox, 2007), a text often used as a general introduction to Rasch theory and practice. This version, sometimes referred to as "Bond and Fox Steps," has no restrictions on the number of items or persons that can be analyzed, but provides only basic output and is configured to easily run the examples used in the Bond and Fox text. Using Bond and Fox Steps to analyze your own data is possible, but cumbersome. All versions of Winsteps require Windows 98 or higher.

RUMM 2020

RUMM 2020 (Andrich, Lyne, Sheridan, & Luo, 2003) was developed by David Andrich, originator of the Rasch-Andrich rating scale model, and colleagues at the RUMM Laboratory in Perth, Australia. A time-limited version of RUMM is usually provided as part of a popular online course in Rasch measurement offered periodically by Dr. Andrich through the University of Western Australia. RUMM provides an all-

graphical interface that uses familiar point and click set-up features, as found in modern statistical packages such as SPSS. It can output a wide range of multicolor charts and graphs, and fit a variety of Rasch models, including dichotomous, rating scale and partial credit models. It is also highly interactive, providing easy re-analysis following diagnosis of previous analyses. RUMM requires Windows XP or higher, with 1 gigabyte of RAM recommended.

A disadvantage of RUMM is the cost: US $700 for a single user academic license. Another potential disadvantage is that the chi-square based fit statistics reported by RUMM are not the familiar Infit and Outfit mean square statistics output by Winsteps and reported in many measurement journals. Learning to interpret RUMM output may require Andrich's online course, or additional study of the RUMM manual, especially for those who have learned Rasch analysis through an introductory text such as Bond and Fox (2007).

Facets

Like Winsteps, Facets (2006) was also developed by Mike Linacre, specifically to handle more complex applications of Rasch measurement. It is a powerful and flexible program that can apply all of the Rasch models available in Winsteps, plus applications that require a many-facet Rasch model. Facets is necessary if one wishes to construct Rasch measures for judged performances involving multiple raters, or situations where examinees respond to different tasks, such as randomly assigned essay prompts.
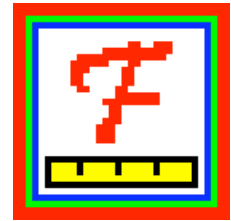
Like Winsteps, Facets requires the analyst to prepare a control file that specifies model parameters and data formats using a special Facets control language. It does not at this time have a graphical set-up module to assist in preparing the control file. Fortunately, the very thorough Facets manual contains example control files for a wide variety of measurement situations. Most novice users search for a control file that is similar to their own circumstances and edit it to suit their needs.

In addition to measures and fit statistics for each measurement facet, the Facets program can construct and output a variety of color charts, graphs, and variable maps that allow examinee ability, judge severity, and topic difficulty to be compared using a unified scale of measurement. Color graphs can be output to depict differential item functioning, rater bias, or unexpected responses. Recent versions of Facets have added features that facilitate integration with Winsteps. Certain Winsteps features, such as principal component analysis of Rasch residuals, are not available in Facets. But for analysts working with complex models who wish to conduct these analyses, Facets can construct appropriate data and control files that can be exported and then run using Winsteps.

Facets currently costs US $149. A free version called Minifac, which is limited to 2000 person/item responses, is also available for download. Both Facets and Minifac require Windows 98 or higher, and because complex Rasch models can require considerable processing time, a recent computer with at least a gigabyte of ram is recommended. Because Facets setup and output are more complex than Winsteps, Linacre (n.d) recommends using Winsteps if the measurement problem does not require a many-facet Rasch model.

Quest

Quest was developed in the 1990s by Ray Adams and Siek-Tooh Khoo (1996) at the Australian Council for Educational Research. It has not been actively supported or updated for some years now, but can still be purchased through Assessment Systems Corporation (www.assess.com) for US $460. Quest is offered in both a Windows and Macintosh version. The Windows version requires Windows 95 or higher, but the Macintosh version now runs only on PowerPC Macs, those sold prior to 2006, using the Classic OS environment. Like Winsteps, Quest is run from a control file and produces graphical output using ASCII characters. Despite its age, many users still find the Quest control language to be intuitively easy to learn and the ASCII-based output very attractive.

Quest is mentioned here because it was used in many published reports during the 1990s as well as for some of the analyses featured in Bond and Fox (2007). However, as there appear to be no plans to update or support it, it is probably not a good purchase option for novices wishing to get started with Rasch analysis.

ConQuest

ConQuest (2007) was developed by Wu, Adams, Wilson, and Haldane at the Australian Council for Educational Research as a more powerful replacement for Quest. It is a powerful and flexible program that combines Rasch item response models with latent regression models, allowing researchers to examine the properties of traditional assessments, surveys employing rating scales, and judged performances. Besides the standard dichotomous, rating scale, partial credit and many-facet Rasch models, ConQuest can also estimate a *multidimensional* Rasch model (Briggs & Wilson, 2003). The multidimensional Rasch model is a recent innovation that is useful when success at a set of tasks requires more than one skill or attribute, an example being algebra word problems, which require both verbal and mathematical skills.

ConQuest has an attractive graphical interface plus an auxiliary consol interface that offers even greater control over model specification. It can output a wide range of colorful and informative graphs, charts, and variable maps. Although ConQuest is by far the most powerful and flexible of the Rasch programs reviewed here, the power comes at a price. Because ConQuest and was designed for the analysis of large scale, district-wide assessments, the underlying model estimation algorithms assume a large sample size and normal distributions of item responses. Both Winsteps and Facets, on the other hand, use estimation methods that have no distributional assumptions. For researchers working with smaller sample sizes or skewed data sets, Winsteps or Facets may be more appropriate. Conquest runs on all versions of Windows and can be purchased from Assessment Systems Corporation for US $699.

Rasch Analysis using the Macintosh

There are currently no Rasch analysis programs that run natively on Mac OS X. Macintosh users, however, can run the applications reviewed in this article by using Windows emulation software or Apple's Boot Camp. Emulation programs open Windows applications in a separate window while running Mac OS. The two most popular are Parallels Desktop (www.paralles.com) and VMware Fusion (www.vmware.com/products/fusion). Both are US $80, plus the cost of purchasing Windows.

Apple's Boot Camp, which is free with all Intel based Macs, permits users to install Windows on a separate partition on their hard drive. Users choose at start up whether to launch Mac OS or Windows, which will effectively turn the Mac into a Windows computer. Boot Camp and the two emulators are highly reliable, but they require the user to purchase a boxed copy of Windows which, depending on which Windows edition is chosen, adds two to four hundred dollars to the cost.

CrossOver (www.codeweavers.com) is a cheaper but less reliable alternative for running Windows programs on Macs. It costs US $40, but does not require the user to purchase and install Windows. Many Windows programs, including the Rasch programs reviewed here, will launch and run directly in the Mac OS environment when CrossOver is installed. However, some applications do not display properly or crash when particular functions are employed. A free trial version is available to check whether your Rasch application of choice performs acceptably.

Summary

In this installment, I have provided a brief overview of the more popular software packages for those wishing to experiment with Rasch analysis, or those who are experienced but are looking for a more powerful program. All currently supported Rasch programs require a Windows OS. Check with the venders to see which specific versions of Windows are supported. Macintosh users can also use these programs, but will need to purchase additional software that adds support for Windows applications.

This is by no means a complete list. Many general Item Response Theory programs such as BILOG and MULTILOG can also do Rasch analysis. Although these programs lack the variable maps and other visual

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tools that Rasch analysts frequently employ, they may be an attractive alternative for researchers wanting to investigate both Rasch and 2 or 3 parameter IRT models. For some additional options, see the web store and features comparison tables at Assessment Systems (www.assess.com).

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