

Controlling Item Exposure and Test Overlap in Computerized Adaptive Testing

Shu-Ying Chen

National Chung-Cheng University
160 San-Hsing Village, Min-Hsiung,
Chia-Yi 62107, Taiwan
E-mail: psysyc@ccu.edu.tw

Keywords: Computerized adaptive testing, Item exposure, Test overlap, Test security

Abstract

One practical advantage of computerized adaptive testing (CAT) is that they can be administered on a flexible schedule rather than at fixed times. The convenience and flexibility for examinees, however, may severely compromise test security if item exposure is not well controlled. To date, item exposure rate and test overlap rate are two indices commonly used to track item exposure in CATs (Way, 1998). Despite the importance of both indices in tracking item exposure control, most research to date has focused on item exposure control at the individual item level only. Based on the relationship between the two indices observed in Chen, Ankenmann, and Spray (in press), test overlap rate can be controlled exactly via the mean and variance of the item exposure rates. The mean of the item exposure rates is equal to the fixed test length divided by the item pool size and remains a constant in most testing programs. Thus, the variance of the item exposure rates would be crucial in determining the test overlap rate.

The purpose of this study is to modify the Sympson and Hetter (1985) procedure such that not only can most items be administered with item exposure rates less than a pre-specified value (e.g., 0.2), but also the test overlap rate can meet a pre-specified value (e.g., 0.15). More specifically, the variance and the maximum value of the item exposure rates are controlled simultaneously and exactly in the modified procedure. Thus, based on this approach, item exposure can be controlled at both the item and test levels.

A simulation study will be conducted to investigate the effect of the modified procedure on item exposure control and precision of trait estimation where an ACT-Math item pool is used; initial trait estimates are assumed to be zero; maximization of item information is the criterion used for item selection at each stage; EAP trait estimation is used; and test length is set at 20 items. With respect to item exposure control, the maximum item exposure rate will be set at 0.2 and test overlap rate at 0.15. One thousand simulees will be used at each of seven true trait levels: $\theta_o = -3, -2, -1, 0, 1, 2, \text{ and } 3$. Evaluation criteria will include root mean squared error, average bias, maximum item exposure rate in the item pool, number of items not used, and test overlap rate.

References

- Chen, S., Ankenmann, R. D., & Spray, J. A. (in press). The relationship between item exposure and test overlap in computerized adaptive testing. *Journal of Educational Measurement*.
- Sympson, J. B., & Hetter, R. D. (1985, October). Controlling item-exposure rates in computerized adaptive testing. *Proceedings of the 27th Annual Meeting of the Military Testing Association* (pp. 973-977). San Diego, CA: Navy Personnel Research and Development Center.
- Way, W. D. (1998). Protecting the integrity of computerized testing item pools. *Educational Measurement: Issues and Practice*, 17, 17-27.