



Application Rasch Model and Extended Angoff Developing Golf Ranking System

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ABSTRACT

Background/Purpose: Golf player rankings in Korean high schools are determined by sum of the frequency of successful driving (FSD) shot, frequency of successful approach (FSA) shot, and frequency of successful iron (FSI) shot. Players have to shot five times at each FSD, FSA, and FSI, so 15-score is the best score. However, evidence based on test content by golf experts suggests the driving, approach, and iron shot have different difficulty. Therefore, the purpose of this study is to develop a more fair and accurate ranking system for Korean high school golf players as employing different weights on the three shots.

Method: A total of 282 male high school golf players in 2013 were collected. The frequency of successful(S) and failed(F) at three shots (driving, approach, iron) was counted. To determine the difficulty of three shots, Rasch analysis with Winsteps 3.62 software (Linacre, 2009) was employed. The model fit criteria was set by Infit and Outfit statistics (≥ 0.50 and ≤ 1.50). Based on obtained difficulty score from Rasch analysis, weight scores on the three shots for S and F shots were assigned by five golf experts as employing three rounds of the extended Angoff method.

Analysis/Results: The difficulty of three shots from Rasch analysis showed acceptable model-data fit. The most difficult shot was to success was approach (logit=1.02) compared to other shots (iron=0.75, & driving=-1.78). Based on the difficulty obtained from Rasch model, weight scores assigned from extended Angoff were as follows: FSA=1.50 vs. FFA (frequency of fail approach)=1.00, FSI & FFI (frequency of fail iron)=1.44, FSD=1.00 vs. FFD=1.50 (frequency of fail driving). Utilizing the weight of the shots, the derived equation for the player rankings is = [(FSA×1.50)+(FSI×1.44)+FSD]-[FFA+(FFI×1.44)+(FFD×1.50)].

Conclusions: The newly developed high school golf male player ranking system should be validated to another sample (e.g., players in 2014) before applying to real evaluation. In addition, the derived equation in this study may be able to apply for male players only, but not for female players

METHODS

Rasch Model: Rasch model is one part of Item Response Theory(IRT). Rasch models are used for analyzing data from assessments to measure variables such as abilities. The logit function is an important part of Rasch model. It is a special case of a link function in a generalized linear model. In this study, difficulty of golf shots can be calculated by logit using Rasch model. To determine the difficulty of the three shots, Rasch analysis with Winsteps and Facets software was employed. The model fit criteria was set by Infit and Outfit statistics (≥ 0.70 and ≤ 1.30). If the PMC(Point-Measure Correlation) is higher than 0.30 or SI(Separation Index) is higher than 2.00 and RI(Reliability) is higher than .80, these mean the satisfaction of unidimensionality in IRT. Number of Distinct Strata is $NDS = [(4 \times SI) + 1] / 3$, so NDS index by separation Index shows what number of strata is better in variables.

Extended Angoff: Using an Extended Angoff Procedure to set standards on weight score in this study. Based on obtained difficulty score from Rasch analysis, weight scores on the three shots (driving, approach, iron) were assigned by three golf experts as employing two rounds of the extended Angoff method in three weeks.

Item Characteristic Curve: Item characteristic curve (ICC) is the primary concept in IRT. It is a mathematical expression that connects or links a subject's probability of success on an item to the trait measured by the set of test items. ICC is a non-linear(logistic) regression line, with item performance regressed on examinee ability. In this study, we can consider that items are the golf shots(driving shot, approach shot, iron shot). Winsteps program and Facets program that are Rasch program show expected score ogive, empirical ICC and upper 95% 2-sided confidence interval and Lower 95% 2-sided confidence interval

RESULTS & CONCLUSION

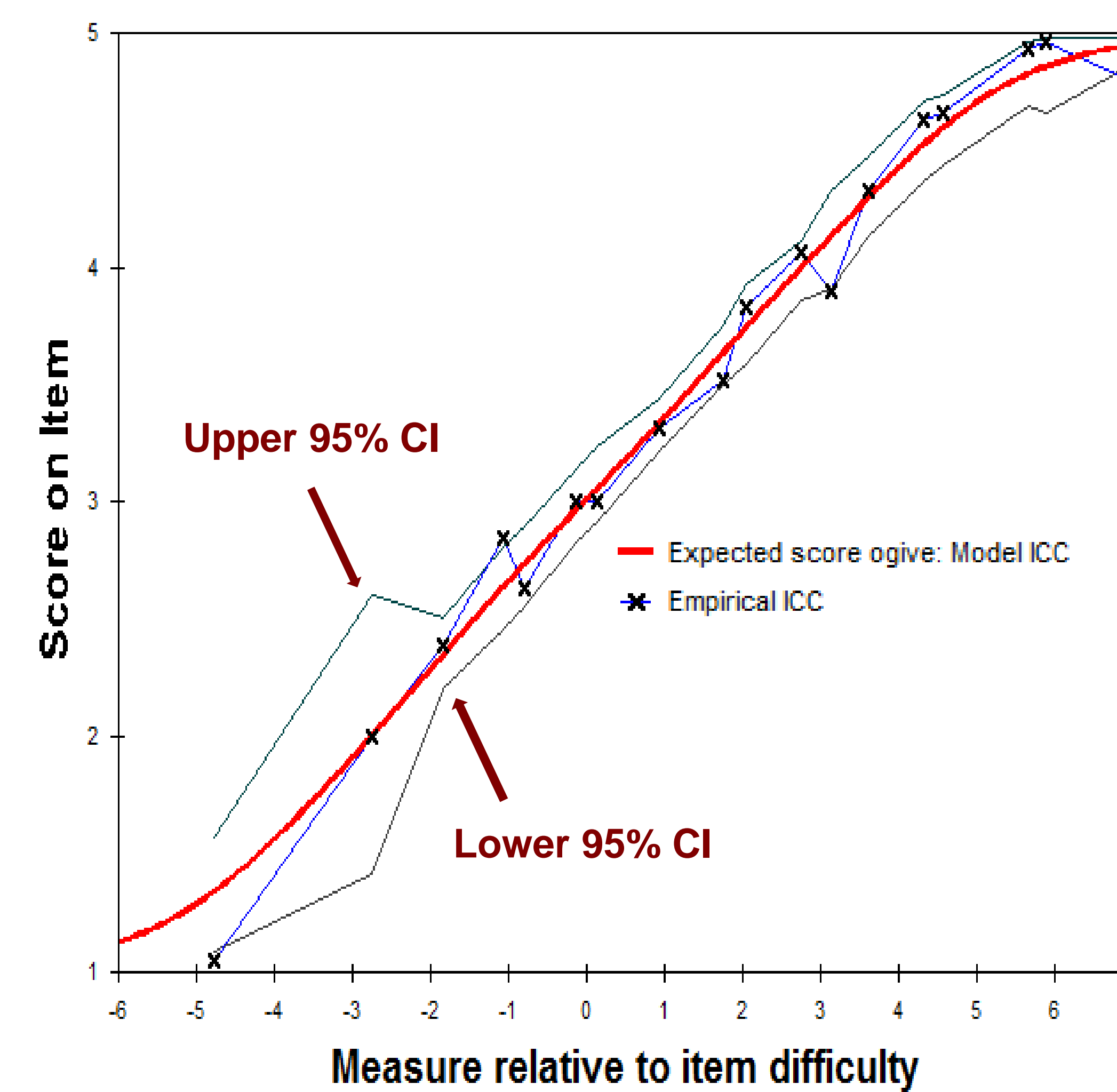


Figure 1: Item Characteristic Curve

Figure 1 is item characteristic curve (ICC) to show goodness-of-fit. Specifically, a horizontal axis is measure relative to item difficulty that means driving shot difficulty, approach shot difficulty, and iron shot difficulty. The measured data(driving, shot score, approach shot score, iron shot score) in this study is verified to utilize Rasch model because empirical(estimated) ICC is in the 95% appropriated confidence interval.

Table 1: Difficulty of variables

	Logit	SE	Infit	Outfit	PMC
Driving shot	-1.78	.11	1.17	1.34	.74
Iron shot	.75	.10	.82	.82	.86
Approach shot	1.02	.10	1.00	.99	.77

$$\chi^2(2) = 405.70, p < .001, SI = 11.58, RI = .99, NDS = 15.78$$

Table 1 shows result of difficulty of variables. Logit is difficulty index to increase validity in Rasch model. SE is standard error that means significance variance each variable.

Infit and Outfit show model fit and data consistency. PMC and SI and RI have criterion to measure Rasch model requirement. NDS suggests what number of strata is statistically better in variables.

Approach shot was the highest difficulty (logit=1.02), and Iron shot was next high difficulty(logit=.75). Driving shot had the lowest difficulty(logit=-1.78). Each SE showed very similar indexes that mean each variable had similar variance. Infit and outfit acceptable model fit-criterion (≥ 0.50 and ≤ 1.50). All PMC, SI, and RI showed higher than criterion, these mean the satisfaction of unidimensionality condition. NDS(15.78) suggested about 16 strata is better statistically. Based on the difficulty obtained (approach=1.02, iron=0.75, driving=-1.78) from Rasch model, weight scores assigned from extended Angoff and using mathematics proportion. Table 2 shows result of the angoff and proportion. FSA(Frequency of Success Approach)=1.50 vs. FFA(Frequency of Fail Approach)=1.00, FSI(Frequency of Success Iron & FFI(Frequency of Fail Iron)=1.44, FSD(Frequency of Success Driving shot)=1.00 vs. FFD(Frequency of Fail Driving shot)=1.50.

Table 2: Weight of variables

	Logit	Weight
Driving shot	-1.78	1.00
Iron shot	.75	1.44
Approach shot	1.02	1.50

Utilizing the weight of the shots, the derived equation for the high school golf rankings system(HGRS) in Korea is follow.

$$HGRS = [(FSA \times 1.50) + (FSI \times 1.44) + FSD] - [FFA + (FFI \times 1.44) + (FFD \times 1.50)]$$

The derived equation(HGRS) in this study may be able to apply for Korean high school golf players. I hope HGRS can be based to develop the other golf players' ranking system equation.

