Validation of IPMS for Korea Archery

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ABSTRACT

Background/Purpose: The purposes of this study were to develop and calibrate the Importance of Performance Measurement Scale (IPMS) for Korea archery using the Rasch model, and to validate the scale through known group difference approach. If the Experience of Archery (EOA) score is more than 10, independent coaching is generally possible (Korea Archery Association, 2012).

Method: Based on the literature review and consultation of content and measurement experts, the 27-item IPMS was generated. The scale was administered to 463 Korean elite archeries in Korea Seoul universities. Rasch measurement computer program, WINSTEPS, was used to analyze the data. Model data fit was determined by Infit and Outfit statistics (≥0.70 and ≤1.30). The unidimensionality of the scale was determined by Infit and Outfit (mean square) using Chi-square fit statistics. If the values of the Infit and Outfit are 1.00, the observed score perfectly fit the expected model. One-way ANOVA was used to establish the known group difference validity evidence of the IPMS through SPSS 21.0 statistical software. Alpha level was set at 0.05. A statistically significant mean difference in the archeries' importance of performance between EOA score level(<10, ≥10) would provide known group difference validity evidence for the IPMS.

Analysis/Results: 22-item of the 27 items had good model-data fit with acceptable fit statistics. The five items were eliminated from the final estimation (the 5-item's infit and outfit statistics index were over 1.30). Overall, a unidimensional model fits the data well and the 7 rating categories functioned well; threshold advanced with category. The item separation index (2.57) and separation reliability statistic (.98) provided evidence that the items had good variability with a high degree of confidence in replicating placement of the items from another sample. There was a statistically significant mean difference in the person's logits score between categorized the EOA group(<10, ≥10), $F(1, 461) = 7.609$, $p < .006$. This result supports the known group difference validity evidence of the IPMS.

Conclusions: Results provided support for using the IPMS. The scale can be used to assess the importance of performance of individuals and provide information to Korea Archeries. The newly developed IPMS for archer in Korea should be validated to another sample to increase external validity.

ITEM & SCALE

Table 1. 25-Item contents

To increase archery ability	
1	Long distance running
2	Drawing a bow without an arrow
3	Shoulder flexibility for drawing
4	Weight training: upper body
5	Weight training: lower body
6	Grip strength
7	Closed-eye foot balance
8	Stance with consistent foot placement and angle
9	Set up by maintaining left-right shoulder level
10	Consistent drawing
11	Full anchoring
12	Consistent extension by maintaining left-right shoulder level
13	Shoot with consistent clicker time
14	Release by fixing sight pin to middle of target
15	Release by maintaining pace and direction of arm
16	Maintain posture with same direction and tension after shooting
17	Aim confidently in rain or wind
18	Self-management
19	Image training before and after match
20	Establishment of target
21	Believe in my skills
22	Self-talk before shooting
23	Positive thinking
24	Maintain composure
25	Remove anxiety and tension
26	Concentrate on match
27	Follow own routine before shooting

= NOT Goodness-of-fit =

Based on content validity, 27-item was selected and measured by seven likert importance scale (1-Not at all important, 2-Low importance, 3-Slightly important, 4-Neutral, 5-Moderately important, 6-Very important, 7-Extremely important) The number of the 25-item contents are shown in Table 1.

RESULTS & DISCUSSION

Table 2. Analyzing dimensionality

Table of STANDARDIZED RESIDUAL variance (in Eigenvalue units)

		-- Empirical --		Modeled
Total raw variance in observations	=	63.0 100.0%		100.0%
Raw variance explained by measures	=	36.0 57.1%		60.1%
Raw variance explained by persons	=	20.0 31.8%		33.4%
Raw Variance explained by items	=	16.0 25.4%		26.7%
Raw unexplained variance (total)	=	27.0 42.9%	100.0%	39.9%
Unexplned variance in 1st contrast	=	3.7 5.9%	13.7%	
Unexplned variance in 2nd contrast	=	2.9 4.6%	10.6%	
Unexplned variance in 3rd contrast	=	1.7 2.6%	6.1%	
Unexplned variance in 4th contrast	=	1.5 2.4%	5.7%	
Unexplned variance in 5th contrast	=	1.3 2.1%	5.0%	

Table 3. Item fit

ENTRY NUMBER	TOTAL SCORE	COUNT	MEASURE	MODEL S.E.	INFIT MNSQ	INFIT ZSTD	OUTFIT MNSQ	OUTFIT ZSTD
22	2300	463	1.15	.04	1.75	9.2	1.88	9.9
27	2728	463	.26	.05	1.56	6.6	1.62	6.8
1	2221	463	1.28	.04	1.37	5.1	1.44	5.9
21	3049	463	-.94	.08	1.35	3.3	1.12	1.1
20	3085	463	-1.18	.09	1.35	3.1	1.28	2.3
7	2157	463	1.39	.04	1.17	2.6	1.19	2.7
11	2656	463	.44	.05	1.12	1.6	1.16	2.1
6	2602	463	.56	.05	1.15	2.1	1.15	2.0
3	2685	463	.37	.05	1.10	1.4	1.15	1.9
8	2689	463	.36	.05	1.00	.0	1.07	.9
2	2615	463	.53	.05	1.05	.7	.99	-.1
25	2916	463	-.32	.06	1.04	.5	1.02	.3
13	3033	463	-.85	.07	1.04	.4	.85	-1.5
14	2913	463	-.30	.06	1.02	.3	.92	-.9
17	2915	463	-.31	.06	.96	-.5	1.02	.2
23	3004	463	-.69	.07	.98	-.2	.99	.0
26	3057	463	-.99	.08	.92	-.8	.81	-1.9
18	2999	463	-.67	.07	.89	-1.3	.75	-2.7
12	2797	463	.07	.05	.84	-2.1	.84	-2.1
24	2960	463	-.49	.07	.84	-1.9	.81	-2.2
5	2580	463	.61	.05	.81	-2.9	.84	-2.4
10	2928	463	-.36	.06	.84	-2.1	.82	-2.1
16	2906	463	-.28	.06	.83	-2.1	.77	-2.9
15	2871	463	-.16	.06	.82	-2.4	.75	-3.3
19	2711	463	.31	.05	.81	-2.7	.81	-2.6
4	2704	463	.32	.05	.78	-3.3	.79	-2.9
9	2864	463	-.13	.06	.74	-3.6	.74	-3.3
		ITEM: REAL SEP.: 10.82		REL.: .99				

Table 2 shows ensure that the scale(table 1) is unidimensional. Empirical is variance components for observed data, model is variance components expected for the data. Total raw variance is observations is total variance in the observations around their Rasch expected values in standardized residual units. Variance explained by measures is variance explained by the item difficulties, person abilities and rating scale structures

Raw Unexplained variance(total) is variance not explained by the Rasch measures. Unexplained variance is 1st contrast shows the biggest residual dimension is 3.7. If the first factor(1st) has an eigenvalue less than 3.0, the test is probably unidimensional, and simulation studies indicate that an eigenvalue less than 1.4 is at the random level; larger values indicate there is some structure present. It is seen that the value of 1.4 is always exceeded by the first eigenvalue, and usually by the second(Smilth, 1994; Connor, 2000). Consequently, the recommendation is to decide the criterion eigenvalue directly from relevant simulations. So IPMS may be not satisfied unidimensinality. However, it's criterion is never perfect index(always approximate), and item separation index(10.82), and reliability(.99) were satisfied.

Table 4. ANOVA for Known group difference validity

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.510	1	2.510	7.609	.006
Within Groups	152.065	461	.330		
Total	154.575	462			

Table 4 is result of known group difference validity. A statistically significant mean difference in the archeries' importance of performance between EOA score level(<10, ≥10) would provide known group difference validity evidence for the IPMS[$F(1, 461) = 7.609$, $p < .006$)].

CONCLUSION

The 22-item provided support for using the IPMS. it can be used to measure importance of performance and provide information to Korea Archeries. The newly developed IPMS for archer in Korea should be validated to another sample to increase external validity. Cross-validation methods should be used to check on external validity. It's meaning that another approach to maximize external validity is to perform a cross-validation or replication.