An Analysis of the skill outcomes in Recurve men.

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Abstract

The purpose of the study was to analyze the shooting skills of athletes by using many-facet Rasch model in the Recurve men. The subjects were eight male archers who were in the selection of national team. The data of performance included the qualification and elimination rounds in Recurve. The data were analyzed by Facets Rasch software. The shooting skill of Recurve included four key elements (facets): Archer, Distance, End and Order. The scale of skill was created, using Infit (the information-weighted mean-square fit statistic), Outfit (the outlier sensitive, mean-square fit statistics), Measure (logit estimate of the calibration/measure in log odds units), Model S.E. (standard error), and unexpected responses in all facets. An individual skill type and character were based on unexpected responses and standardized residual to analyze further. The results could provide objectively information that coaches might use in drill and practice. Therefore a conclusion was that using the unexpected responses of Rasch measurement might detect the skill outcomes of archers in the Recurve.

Keywords: Recurve, many-facet Rasch model, skill outcomes, unexpected responses.
INTRODUCTION

According to the “FITA CONSTITUTION AND RULES 2006” (International Archery Federation, 2007a) of International Archery Federation (Fédération Internationale de Tir à l’Arc, FITA) in 2007, Archery consists of Outdoor Target Archery, Indoor Target Archery, Field Archery, Ski-Archery, and Miscellaneous Rounds. Because of too many kinds of archery, archery is classified by recreation and sports. But there are only four (Recurve only) of Men’s Individual, Women’s Individual, Men’s Team, and Women’s Team to be the formal competition events in Olympic Summer Games (FITA, 2007b) and Asian Games.

The outdoor target archery in 15th Asian Games Doha 2006 had two steps: qualification round and elimination round. In the first step, qualification round takes place over four different distances ranging 30 - 90 meters, starting with the longest. Men shoot from 90m, 70m, 50m, and 30m. Women shoot from 70m, 60m, 50m, and 30m. There are totally 144 arrows and 36 arrows from each distance, which is called “The FITA Outdoor Target Archery Round (FITA, 2007b)”. Qualification round proceeded twice The FITA Outdoor Target Archery Rounds. In the second step of elimination round is used Olympic round, the top 64 go through to the Olympic round; in the team competitions, the top 16 teams go through. The Olympic round is a straight knockout with competitors seeded by the placings in the qualification round. So, number 1 plays number 64, number 2 plays number 63. And so on. In the Olympic round, all arrows are shot from 70m at a 122cm target. The two finalists shoot for the gold and silver medals, with the bronze medal decided in a play-off match. In the team event, teams of three archers shoot three arrows each over three ends. The total
points scored by all 27 arrows decide the winner (Three arrows x three archers x three ends = 27 arrows).

**Archery**

Archery has a long history and was used in hunting and warfare. The first archers were hunters looking to kill animals for food. Later bows and arrows became a feared weapon of war. Today most archers shoot their bows for sport, to test their accuracy firing at a target. Archery featured in the second Modern Olympic Games in 1900, but was dropped between 1920 and 1972. In the Asian Games, archery competitions were held in Tokyo in 1958 and Jakarta 1962 then, after a 16-year break, it has returned at every Asian Games since Bangkok 1978. According to FITA recognizes bow equipment the following Divisions: recurve bow, compound bow, barebow, longbow or bowhunter. (FITA, 2007c) There is only Recurve Division in the Olympic Games and Asian Games.

Archery is the important capacity for evolution of hunting culture, and is easy to understand as soon as people knew the skill. In detail, the skills and equipments of archery is complex and hard to understand. Most researches of archery are about sport psychology and Biomechanics of sport, so we often could not get Generalization. For example, based on Huang (2004) studies “A Tremor Measurement System for the Preliminary Study of Stability of the Archery”, we found out that “We will use the accelerator as the sensor to detect and record the variation of the velocity of arrows in terms of different levels of tremor. After processing the signals, we may study the performance of different excellence resulted from different degrees of tremor. With the benefit of sensitivity of accelerators, we can analyze the whole process from
drawing to release to find out flaws in posture and provide useful information on
training.” In theory, a tremor affected flight to get bad scores, but this situation is not
fitted for all archers. That means there are some unknown variables affecting
performance. For example, D'Arripe-Longueville, Saury, Fournier, & Durand (2001)
found “This innovative approach which enables the activities and the thinking
processes of coaches and athletes in particular situations to be analyzed in depth has
been used in the training program of the French national team in preparation for the
1999 archery World championships and the Sydney Olympic Games. Such
frameworks could help other practitioners be more aware of their actions,
communication and preoccupations in training or competitive situations, and to
improve the coordination of their respective activities.”

This research tried to analyze the performance of competition for archers based
on the view of measurement. By the skill outcomes, we could discuss the response for
process of competition. By objective of Rasch Measurement, we could know personal
performance for archers, and hope to become the way to promote level of archery
competition.

Theoretical Framework

The objective measurement has been extended since The first PROMS meeting,
PROMS KL 2005, was successfully held at Kuala Lumpur Malaysia in 21-23 June
2005, and today PROMS TW 2007 is to be held in Tao Yuan, Taiwan, from 17-19 July
2007. The purpose is to extend researches about Item Response Theory and Rasch
Model in the area of Pacific Rim and developed tool of measurement by application
for this theory. So Rasch Model is effective on measurement of objectively and
precisely. Why can Rasch Model measure objectively? Based on theory, Wright and Stone (1979), the book named “Best test design: Rasch measurement” introduced: “The Rasch model makes certain plausible assumptions about what happens when a person takes an item, and a complete analysis must include an evaluation of how well the data fit these assumptions.” When data fitted Rasch Model, we could establish the foundation of objective and quantifiable measurement by the assumption of Rasch Model. At the same time, Wright and Stone (1979) thought “With this table we can more easily study the outstanding unexpected correct or incorrect responses”. Rasch could analyze not only the capacity of examinee but also abnormal performance of response. To amplify the application for Rasch Measurement, Wright and Masters (1982) pointed out “Item Fit statistics play an important role in the construction and calibration of an instrument. Person Fit statistics are useful for assessing the validity of measures made with instruments which have already been established.” In the traditional testing construction of psychology, society, and education, they all used Rasch Measurement to objective measurement. De Gruijter and Van der Kamp (2005) pointed out validity and its sources of evidence is one of response processes and “Response processes refer to the detailed nature of performance. It generally comes from analyses of individual responses (e.g., do test takers use performance or response strategies; are there deviant responses on certain items, etc.).” So response processes are the important part of measurement, and we also have to take an eye on detail characters of individual score performance.

**Purpose**

Our purpose of this research is to analyze the performance of Recurve by application of many-facet Rasch model and discuss the skill characteristic of personal
LITERATURE REVIEW

The following are the literatures about application of Rasch Measurement for performance in physical education and sports:

In physical education and exercise science, the first study of item response theory (IRT) was “IRT person fit statistics to diagnose motor function” by Cole and Zhu in 1994. Cole and Zhu (1994) presented “In the pure measurement, unfit often indicates an odd response pattern. …..an unfit response may reflect an examinee’s unexpected strength or weakness …..Overall, examinee misfit ratings accounted for only a very small proportion (1.95%) of the valid ratings. IRT personal fit indices provided a useful reference”. In the Taiwan, the first study of Rasch measurement was “The study of adaptability to fixed-length testing on the motor skill” by Yau in 1995. Yau (1995) conclusions were that “1> The fixed-length test has just finished the construction of an adaptability test. 2> The fixed-length test has just finished the construction of an adaptability test. 3> The property of adaptability test were less trails and high quality test in the fixed-length test of motor skill. 4> The adaptability test could do valid measurement for any ability levels in motor skill.”

After that, measurement of physical education and sports opened a new way for objective measurement in Taiwan. Yeh and Yau (2000) found out that “About further discussion of items, we can use WINSTEPS to estimate the misfit response of
examinee, unexpected response, and data of items in detail. And then modify the inner problem of “the questionnaire of sports coach evaluation”. These researches began to pay attention to the problems of unexpected response, and thought they will be useful furthermore.

Tseng (2001) evaluated the rating of dance sport's judge in the final of the 13th Asian Games. He was “used three facet Rasch model, testing fit statistics and unexpected responses. The results showed that there were two unfair judges and six unexpected responses. The unexpected responses had been explained by systematic error, misjudging, and slipping of pen”. To sum up, it is the most important character for Rasch Measurement to present the detailed response and take care of score performance.

The research of Applications of many-facet Rasch model to assess the difficulty of shooting station in Double Trap shotgun written by Wu in 2005 was to assess the difficulty of shooting station in Double Trap shotgun. His conclusion was that “The best difficulty station was first station in Double Trap shotgun; another order from hard to easy were fourth station, second station, fifth station, and third station”. This research is not only like Tseng (2001) to find where the unexpected responses are but also know the further relationship of facets.

Yau (2006) studied “Application of many-facet Rasch model to analyze the skills of elite athletes in Double Trap”. The shooting skill of research included eight key elements (facets): Shooter, Program, Date, Trap Setting, Round, Starting station, Firing station and Target in Double Trap. When the data fit model, the study may detect professional skills’ tarnish from systematic patterns of misfit to analyze a bias
promptly. Yau (2006) found out “The unexpected responses were all less than -2 of standardized residual in this study. In Rasch measurement, it represented that “the higher capability we estimated, the less capability for performance we could find out”. In other words, an elite shooter’s fault was the shooter’s disadvantage judging from the viewpoint of sports skill that it’s also the object for shooter to train more.” In physical education and sports, the standardized residual of unexpected responses was detecting individual characters. The results of Rasch measurement can provide useful information that coaches and archers might use in drill, practice, and game.

**METHOD**

The subjects were eight male archers who were the selection of national team in final. The archers were 1 C. W. KUO, 2 C. P. WANG, 3 S. Y. CHEN, 4 T. Y. HSU, 5 M. H. LIU, 6 H.C. LAI, 7 C. C. SU, and 8 C. L. YU. The data of performance included the qualification and elimination rounds in Recurve. The data were analyzed by Facets Rasch software. The shooting skill of Recurve included four key elements (facets): Archer, Distance, End, and Order.
RESULTS

The analysis of this research is separate to four parts, and there are the measurement of the skill in archery, unexpected response, person’s skill type, and character.

Measurement of Skills in Archery

Table 1 is the summary of calibration for the skill of male in the facets of archer, and testing Data-Model Fit Index consist of Outfit MS (short for “outlier sensitive mean square residual goodness-of-fit statistic”) and Infit MS (short for “information weighted mean square residual goodness-of-fit statistic”). The expectation value of Infit MS is one, which range is from zero to infinite. According to Linacre (2005), the direction pamphlet of Winsteps offered a standard which both Infit MS and Outfit MS produce effective measurement. Table 1 was shown that in all factors of all facets the minimum and maximum of Infit MS is 0.84 and 1.26, and the minimum and maximum of Outfit MS is 0.82 and 1.19. Above all, they are all in effective measurement of Linacre’s paper, and that means that the data and model of this research are all in fitness. Based on Wright and Masters (1982), they pointed out “When the fit indexes are acceptable, item calibration and measurement are ‘valid’.” The testing result showed that this research is in validity of content and construction. When data and model was fitted, it is in theory to discuss all factors further based on the response of person in Rasch Model.
The measurement of estimation of the factors in Table 1 was shown in calibration. In the facet of Archer, the highest value of measurement is 1.77 for 1 KUO, the value of measurement for 3 CHEN is 1.50, the value of measurement for 2 WANG is 1.46, the value of measurement for 4 HSU is 1.44, the value of
measurement for 5 LIU is 1.44, the value of measurement for 6 LAI is 1.34, the value of measurement for 8 YU is 1.19 and the value of measurement for 7 SU is 1.13. The Model S.E. is from 0.06 to 0.08, and they are over 0.99 in Alpha reliability. The chi-square testing value is 59.9 ( df = 7 ) in the facet of archer, and it reached significant level of p<.05, so we know that latent abilities for eight archers is unequal in the facet of archer. In the estimation measurement value of facet of distance, the difficulty estimates on 30 m is -0.99 whose difficulty is lowest, and then the difficulty estimates on 50 m is 0.01, the difficulty estimates on 70 m is 0.10, and the difficulty estimates on 90 m is 0.88 which is the most difficult level. The chi-square testing value is 344.0 ( df = 3 ) in the facet of distance, and it reached significant level of p<.05, so we know that estimated difficulty for four distances is unequal in the facet of distances. The estimation measurement value of facet of End in order: the difficulty estimates on 6th end is 0.16, the difficulty estimates on 1st end is 0.05, the difficulty estimates on 3rd end is 0.04, the difficulty estimates on 2nd end is 0.00, the difficulty estimates on 4th end is -0.07, and the difficulty estimates on 5th end is -0.18, and the Model S.E. is from 0.05 to 0.09. The chi-square testing value is 10.9 in the facet of End, and it did not reach significant level, so we know that estimated difficulty for six ends is equal in the facet of End. The estimation measurement value of facet of Shooting Order: the difficulty estimates on 6th arrow is 0.14, the difficulty estimates on 5th arrow is 0.05, the difficulty estimates on 4th arrow is 0.00, the difficulty estimates on 3rd arrow is -0.06, the difficulty estimates on 1st arrow is -0.07, and the difficulty estimates on 2nd arrow is -0.07, and the Model S.E. is from 0.05 to 0.06. The chi-square testing value is 10.9 in the facet of Shooting Order, and it did not reach significant level, so we know that estimated difficulty for six arrows is equal in the facet of Shooting Order.
Analysis of Unexpected Response

The programming of this research set that the Standardized Residual of unexpected observations are equal or over 2.0 of absolute value. The result of estimation (in table 2): Which the Standardized Residuals of male archers are -7.0, -6.0, -5.0, and -4.0 is 1.30%, and which the Standardized Residual of male archers of sixteen data of population is -3.0 is 20.78%, and which the Standardized Residual of male archers of fifty-seven data of population is -2.0 is 74.03%, and above all are seventy-seven data. The unexpected values are only 3.34% of 2304 data. These show that archers have bad performance, and are thought as personal disadvantage of archers. The Standardized Residual which is -4.0 or higher is called missing target, and it is abnormal performance seriously. The frequency of unexpected values of this research is 3.34% of all unexpected values, and comparison with yau (2006) which the rate of the skills of elite athletes in Double Trap is 7.57%, the rate of frequency of unexpected values is under half. On the other word, the archers of the research have more stable performance than the archers of yau (2006).

<table>
<thead>
<tr>
<th>Standardized Residual</th>
<th>Frequency</th>
<th>Percent</th>
<th>Cumulative Frequency</th>
<th>Cumulative Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>-7</td>
<td>1</td>
<td>1.30</td>
<td>1</td>
<td>1.30</td>
</tr>
<tr>
<td>-6</td>
<td>1</td>
<td>1.30</td>
<td>2</td>
<td>2.60</td>
</tr>
<tr>
<td>-5</td>
<td>1</td>
<td>1.30</td>
<td>3</td>
<td>3.90</td>
</tr>
<tr>
<td>-4</td>
<td>1</td>
<td>1.30</td>
<td>4</td>
<td>5.19</td>
</tr>
<tr>
<td>-3</td>
<td>16</td>
<td>20.78</td>
<td>20</td>
<td>25.97</td>
</tr>
<tr>
<td>-2</td>
<td>57</td>
<td>74.03</td>
<td>77</td>
<td>100.00</td>
</tr>
</tbody>
</table>

To understand what kind of elements is easy to produce unexpected responses, we need to find out the differences of unexpected values which are shown on the
testing of the all frequency for factors of all facets. The Standardized Residuals of Table 3 are all negative, and these unexpected responses are the disadvantages of personal skill of archers (those who “the higher capability we estimated, the less capability for performance”). In the table 3, the facets of Archer, Distance, Round, Order did not reach the significant level of $p< .05$, so we said that the frequency of unexpected response of the factors in all facets is equal. On the other word, the circumstances which the unexpected responses were produced from eight archers, four distances, six rounds, and six orders are the same.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Testing of the unexpected responses in facets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Archer</td>
<td>Distance</td>
</tr>
<tr>
<td>df</td>
<td>$\chi^2$</td>
</tr>
<tr>
<td>7</td>
<td>12.45</td>
</tr>
</tbody>
</table>

* $p< .05$.

**Analysis of Person’s Skill Type and Character**

Because of the lower rate of unexpected response, we could not use statistical analysis to test personal difference. The only thing we could do for the distribution of frequency of unexpected response is to put more descriptions. The chi-square testing for the facets of Archer and Distance reached significant level, so it is meaningful to analyze these facets. The following is the analysis of archer whose performances are particular.
### Table 4  Summary of unexpected responses for 1 Kuo

<table>
<thead>
<tr>
<th>Number</th>
<th>Score</th>
<th>Expected Score</th>
<th>Residual</th>
<th>Program</th>
<th>Distance</th>
<th>End</th>
<th>Shooting Order</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td>9.2</td>
<td>-7</td>
<td>elimination</td>
<td>70m</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>9.2</td>
<td>-6</td>
<td>elimination</td>
<td>70m</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>9.4</td>
<td>-2</td>
<td>qualification</td>
<td>50m</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>7</td>
<td>9.3</td>
<td>-2</td>
<td>qualification</td>
<td>50m</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>7</td>
<td>9.3</td>
<td>-2</td>
<td>elimination</td>
<td>70m</td>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

The lowest frequency of unexpected response is produced from NO.1 archer (Universiade 2005 Izmir Men’s Recurve Gold medal), and there are only five times. The worst performances are produced from the 3 points and 4 points which are the sixth arrow in the third End and last arrow of elimination round in detail (table 4), but the archer won the two games, so NO.1 archer whose value of estimated measurement (1.77) is the highest has strong proficiency. Before last arrow, NO.1 archer had been in the lead position. Another worst performance is produced from the 7 points which is the fifth arrow in the third End in elimination round, but the archer won the game also. The other unexpected response for NO.1 archer was shown on qualification round that 50m had the 8 points and 7 points. On the other, “7 points” is the performance of low capacity because the expectation value of scores is from 9.2 to 9.4.

In the table 5, The lowest frequency of unexpected response is produced from NO.1 archer who only had five unexpected responses at “50m” for twice and “70m” for three times. The value of estimated measurement for NO.1 archer is 1.77 which is the highest latent ability of all archers and less mistakes, so NO.1 archer is an outstanding and stable archer. Secondly, NO.2 archer had six unexpected responses at “50m” for once, “70m” for four times, and “90m” for once. The value of estimated
measurement for NO.2 archer is 1.46 whose latent ability is in the third place of all archers. NO.2 archer should pay attention to the game of the distance of “70m”, and this is important for archers because this distance is for elimination round.

Table 5  Frequency of unexpected responses on archer and distance

<table>
<thead>
<tr>
<th>Distance</th>
<th>2 WANG</th>
<th>8 YU</th>
<th>4 HSU</th>
<th>1 KUO</th>
<th>3 CHEN</th>
<th>5 LIU</th>
<th>6 LAI</th>
<th>7 SU</th>
</tr>
</thead>
<tbody>
<tr>
<td>30m</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>6.25%</td>
<td>14.29%</td>
<td>18.18%</td>
<td>20%</td>
<td>6.67%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50m</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>16.67%</td>
<td>25%</td>
<td>40%</td>
<td>18.18%</td>
<td>30%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70m</td>
<td>4</td>
<td>9</td>
<td>5</td>
<td>3</td>
<td>7</td>
<td>5</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>66.67%</td>
<td>56.25%</td>
<td>71.43%</td>
<td>60%</td>
<td>63.64%</td>
<td>50%</td>
<td>66.67%</td>
<td>100%</td>
</tr>
<tr>
<td>90m</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>16.67%</td>
<td>12.5%</td>
<td>14.29%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26.67%</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>16</td>
<td>7</td>
<td>5</td>
<td>11</td>
<td>10</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Whose latent ability is in the second place is NO.3 archer, and the value of estimated measurement for NO.3 archer is 1.50, but NO.3 archer had eleven unexpected responses at “30m” for twice, “50m” for twice, and “70m” for seven times whose unexpected responses are more than the former two archers. NO.3 archer’s mistakes (unexpected response) were produced at shorter distance, but there were no mistakes at longer distance of “90m”.

The values of estimated measurement for NO.4 archer and NO.5 archer are 1.44, so both of them have the same latent ability. Based on the selection rule of national team, unfortunately, there is only one of them being chosen for national team of four archers allowed. Finally NO.4 archer was chosen. According to the value of estimated measurement, NO.4 archer had seven unexpected responses at “30m” for once, “70m”
for five times, and “90m” for once. NO.4 archer’s the frequency of unexpected responses is in the third place of all male archers. Comparing with NO.5 archer who had ten unexpected responses at “30m” for twice, “50m” for three times, and “70m” for five times, NO.4 archer’s performance is stable. The types of performance of two archers are different and NO.4 archer is good at shorter distances (there are less unexpected responses at “30m” and “50m”), but NO.5 archer is good at longer distances (there are less unexpected responses at “90m”).

The value of estimated measurement for NO.6 archer is 1.34 (in the sixth place), and had fifteen unexpected responses at “30m” for once, “70m” for ten times, and “90m” for four times. The type of unexpected responses of NO.6 archer is similar to NO.4 archer, and NO.6 archer is good at shorter distances (unexpected responses at “30m” for once, and the frequency of unexpected response at “50m” is zero), but is bad at 70m distance. The frequency of unexpected responses for NO.6 archer is twice than NO.4 archer, so NO.6 archer’s performance is not stable.

The values of estimated measurement for NO.8 and NO.7 archer are 1.19 and 1.13, and their latent abilities are bad. NO.8 archer had sixteen unexpected responses at “30m” for once, “50m” for four times, “70m” for nine times, and “90m” for twice. NO.8 archer had the highest frequency of unexpected response which were produced at all kinds of shooting distances, and is the only one. The latent ability of NO.7 archer is the lowest, and NO.7 archer had seven unexpected responses centralizing at “70m”, so the capacity of NO.7 archer is probably stable.
DISCUSSION

They find out that there are differences in personal responses shown on early research of measurement. Wright (1977) described “Analyzing item and Person Fit”: a more extensive analysis of the response pattern of each person can be implemented by evaluating the way in which their residuals correlate with item difficulty, position and type.” Although Classical Test Theory (CTT) was in the leadership for measurement before 1980, Item Response Theory (IRT) rises abruptly and began to discuss personal response. Therefore Bracey & Rudner (1992) pointed out “So wrote Robert L. Thorndike in Lindquist's "Educational Measurement" (1951). Traditionally, research into measurement error has dealt with whether or not the test items fit. But over the last 15 or so years, we have seen mounting interest in whether or not the people who answer the items fit. Most of the interest has centered on people whose responses do not fit the typical pattern.” And this means that the former researches of measurement barely concerned about the characters of examinee, but this research uses characters of examinee to be key points, and in other words we analyze the skill characters of Archer. Meijer (1996) provided eight types of examinees whose unusual patterns of responses could yield test scores that would not provide an accurate estimate of their underlying ability levels. In view of this, abnormal response patterns violate the part of model in measurement. If we analyze personal unexpected responses, we can find more differences in complex variables. In the performances of score, we can find the advantages and disadvantages of skill, so it is worth to analyze special response of Archer further. This research use Rasch Measurement to analyze the skill of archery in Recurve. First, we estimated the fitness between data and model. When data fitted Rasch model, we can find personal types of response to discuss the
skill of Recurve for Archer by unexpected response. Some of the objective researches for more precise skills are quite difficult. We can discuss further based on the description of athlete “there are no regulation in the various application that the adjustment aiming of the direction and the speed of wind will change from personal decision and experience, so archery skill is based on Archer’s trial”

**CONCLUSION**

This study uses Rasch Measurement to analyze the skill performances of eight male Archers on the selection of national Recurve team in 2006 Doha Asian Games, and the data consist of all the performances in qualification and elimination rounds. The method of analysis is the application of the software of Facets, and skill is separated to four facets based on the character of constitution and rules in FITA: Archer, Distance, End, and Shooting Order. After estimation, we make the measurements for all of facets of skills. By the fitness of test, measurement, Model S.E. and unexpected response, we use them to discuss the performance of Archer in selection game; and then discuss personal skill for Archer according to unexpected response and Standardized Residual. Finally we find out that data from completion fit Rasch Measurement. On the other, ‘whether estimations of all facets is equal or not’ shows that both of the facets of Archer and Distance are reaching statistically significant level (p< .05), it means that there are differences between measurements of Archer and the difficulty of distance of archery is significantly different ; Using unexpected response to analyze the type of mistakes(unexpected response) of Archer in different distances of archery further can analyze skills for Archer in
competitions, offer objective data, avoid mistakes of personally subjective decision. Therefore, the conclusion to this research is that we can use the unexpected response of objective measurement to analysis the performances of skills of Archer in Recurve.

REFERENCES


