An observation protocol for skill proficiency assessment in male wheelchair basketball

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Introduction

In wheelchair basketball a functional classification system was introduced to provide a fair competition (Strohkendl, 1986). The players are divided into eight different classes, ranging from 1.0 to 4.5 with half-point intervals, depending on their functional wheelchair basketball specific potential. A 1-point player has a minimal range of action often due to complete paralysis of the lower limbs and trunk. A 4.5-point player has a minimal disability resulting in maximal functional ability comparable to an able-bodied wheelchair basketball player. In international wheelchair basketball competition, a team is composed of players participating with a total amount of points no greater than 14 (IWBF, 2002).

Classifiers observe the sports performance of the athletes and are challenged to distinguish the untrainable, disability-dependent parameters (actual functional capacity of the players) from the trainable, skill-dependent parameters. Only the disability-dependent parameters should determine the classification outcome. A tool to observe the disability-dependent parameters is available (IWBF, 2002). However, no tool exists to judge the skill proficiency of the players. Objective judgment of skill proficiency should minimize the influence of these parameters on the classification outcome. The development of such a tool would also be welcomed by coaches and trainers to detect the players’ flaws and shortcomings in an objective way and to give them appropriate individual training and guidelines. For the above reasons, it seems obvious that there is a need for a well-constructed standardised test instrument to measure wheelchair basketball specific skill proficiency.

The purpose of this study was to develop an observation protocol in which seven specific ball-handling skills (dribble, bounce-stop, bounce-spin, passing, catching, shot and lay-up) were described in a highly mature way. The development of the observation protocol was done in two phases. During the first phase, reference criteria for each skill were derived from an expert panel. Experts in this study were basketball players, graduated as physical educators with a specialization in basketball and adapted physical education. During the second phase, validity and reliability of the observation protocol were measured. Validity of the protocol was established with respect to theoretical hypotheses about expected differences between
players in different international and national levels. The first hypothesis was that the protocol was able to make a distinction between the different skill proficiency levels. Elite players on an international level should have the best scores, whereas the advanced players on a national level should score significantly lower. The second hypothesis was that no significant differences should be found between the classes, because skill proficiency is not expected to be dependent on the functional capacity of the players. Reliability measures included intra and inter observer comparisons as well as internal consistency of protocol items.

Method

Participants
For the first part of this study the sixteen best players of the world (two per class) were selected from the wheelchair basketball world championships 1998 in Sydney and the Paralympic Games 2000 in Sydney. Using the official scouting from these championships, only the players with the highest amount of playing time, assists, scored points and shot-percentages in their class were selected. They played an average of 27.3 minutes per game. During a playing time of 40 minutes, this group gave an average of 4.5 assists, took 14.2 shots and had a shot-percentage of 46.6. The subjects used for the second part of this study were 48 players, subdivided in an elite, sub-elite and advanced group. The elite players were the same sixteen players used in the first part of this study. The sixteen sub-elite players (two per class) also played at the world championships 1998 in Sydney and at the Paralympic Games 2000 in Sydney, but played and performed less than the elite players according to the official scouting. They played an average of 16.6 minutes per game. During a playing time of 40 minutes, this group gave an average of 2.9 assists, took 12.2 shots and had a shot-percentage of 37.3. The sixteen advanced players (two per class) were randomly selected from the four Greek teams playing the national final four 2000 in Serres, Greece.

Protocol development
The first task in the development of the protocol was to select observable performance criteria of seven specific ball-handling skills, which represented the mature pattern for each of the skills. The seven skills were dribble, bounce-stop, bounce-spin, passing, catching, shot and lay-up. Three steps were followed in this process:

1. The (wheelchair) basketball literature was reviewed (Owen, 1982; Hedrick, Byrnes & Shaver, 1994; Boutmans & Rowe, 1997) and video-taped elite players were observed to select the most common performance criteria used to describe a mature pattern for each specialised movement skill.

2. Three wheelchair basketball experts rated each performance criterion on the following criteria: The criterion can be reliably observed on videotape. The criterion is consistent with the literature that describes a mature performance.

3. Those performance criteria that received negative ratings by two or more experts on any of the above criteria were deleted.

To establish content validity three wheelchair basketball experts judged whether the specific skills and their performance criteria are frequently taught to wheelchair basketball players and are used regularly on the court. They were also asked if the skills are representative for wheelchair basketball. Feedback from these three experts was used to revise the observation protocol and to define the criteria more clearly. Using this procedure, a pool of observable performance criteria was generated. As an example, the skill proficiency criteria for SS1 are given in table 1. All skill proficiency criteria are accompanied by a concrete and objective definition. A dichotomous scaling was used, i.e. the criterion is observed or not. The complete observation protocol is available through the corresponding author.

These performance criteria were observed on videotape in the sample of 48 wheelchair basketball players with different performance levels (elite, sub-elite and advanced group). To simplify the analysis the data were reduced to three sub-scores (SS1=dribble + bounce-stop + bounce-spin; SS2=passing + catching, SS3=shot + lay-up) and a total score (TOT=sum of three sub-scores). To set up the formulas for these scores, 435 offences randomly chosen from all games involved in the study, were analyzed. Frequencies of dribble, bounce-stop, bounce-spin,
passing, catching, shot and lay-up were tallied and the relative contribution of each specific motor skill to the sub-scores was calculated.

To compare the skill proficiency of players from different functional classes, players were grouped according to the classification system of the International Wheelchair Basketball Federation (IWBF) which yields four main classes, and according to the classification system applied by the National Wheelchair Basketball Association (NWBA), which yields three main classes (table 2, bottom).

To test the stability of the observation protocol, ten players, randomly selected, were evaluated twice with a time interval of two weeks. To test the inter-scorer reliability, two wheelchair basketball experts watched the same ten players on videotape and analysed the maturity of the players’ skills separately.

<table>
<thead>
<tr>
<th>Dribble</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ball is dribbled in front and close to the side of the wheelchair</td>
</tr>
<tr>
<td>2. The ball is played from the wrist with minimal elbow flexion</td>
</tr>
<tr>
<td>3. Eyes are not fixed on the ball, player keeps overview of the game while dribbling</td>
</tr>
<tr>
<td>4. The wheelchair is continuously positioned between the ball and a defensive player</td>
</tr>
<tr>
<td>5. Player keeps on dribbling while moving the wheelchair</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bounce-stop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ball is dribbled once at the front axle of the wheelchair and caught with the same hand with full control of the ball</td>
</tr>
<tr>
<td>2. The wheelchair is under control, after braking (stopping) using both hands</td>
</tr>
<tr>
<td>3. The bounce-stop is done on the correct side of the wheelchair</td>
</tr>
<tr>
<td>4. Eyes are not fixed on the ball, player keeps overview of the game</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bounce-spin</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The ball is dribbled once at the rear axle of the wheelchair and caught with the other hand with full control of the ball.</td>
</tr>
<tr>
<td>2. The wheelchair is spinned the amount of degrees necessary to execute the next movement.</td>
</tr>
<tr>
<td>3. The spin is done with a minimal displacement of the wheelchair while using both hands.</td>
</tr>
<tr>
<td>4. The bounce-spin can be done in combination with other movements.</td>
</tr>
<tr>
<td>5. Bounce-spin is done on the correct side of the wheelchair.</td>
</tr>
<tr>
<td>6. Eyes are not fixed on the ball; player keeps overview of the game.</td>
</tr>
</tbody>
</table>

Table 1: Skill proficiency criteria for sub-score 1: dribble + bounce-stop + bounce-spin. All skill proficiency criteria are accompanied by a concrete and objective definition. The complete observation protocol is available through the corresponding author.

Statistical analysis
Correlation coefficients were calculated within the three sub-scores and between these scores and the final score to test internal consistency. Pearson correlation coefficients were calculated and a paired t-test was used to investigate the stability and the inter-scorer reliability of the observation protocol. Construct validity was established conducting a two-way analysis of variance with ‘skill proficiency’ and ‘classification’ as the main factors. Additionally, Duncan’s post-hoc analysis was performed. For all analyses, Statistical Analysis System (SAS) was used and significance level was chosen as p < 0.05.

Results
Test-retest correlations were high for all parameters (.76 to 1.00), except for dribble (.62). Paired t-test didn’t show any differences between test conditions. Inter-observer reliability was high, correlation coefficients varying from .88 to 1.00, without any significant difference between the two observers. With respect to the internal consistency, correlations between sub-scores were moderate (.53 to .61). However, correlations between the sub-scores and total score were high (.74 to .89). Construct validity (table 2) shows no significant differences between elite and sub-elite players on all scores.
However, all scores are slightly higher in the elite group. The advanced players scored significantly lower on SS2, SS3, and TOT compared to the elite and the sub-elite group. On SS1 the advanced players only differ significantly from the elite players. No significant differences were found between the IWBF classes and NWBA classes on all sub-scores and the total score (table 2).

<table>
<thead>
<tr>
<th>Sub-score 1 (sd)</th>
<th>Elite</th>
<th>Sub-elite</th>
<th>Advanced</th>
<th>E-SE</th>
<th>E-A</th>
<th>SE-A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>68.6</td>
<td>63.6</td>
<td>52.3</td>
<td>ns</td>
<td>p &lt; 0.05</td>
<td>ns</td>
</tr>
<tr>
<td>Sub-score 2 (sd)</td>
<td>87.2</td>
<td>83</td>
<td>71.3</td>
<td>ns</td>
<td>p &lt; 0.01</td>
<td>p &lt; 0.01</td>
</tr>
<tr>
<td>Sub-score 3 (sd)</td>
<td>59.6</td>
<td>54.7</td>
<td>40.5</td>
<td>ns</td>
<td>p &lt; 0.01</td>
<td>p &lt; 0.05</td>
</tr>
<tr>
<td>Total (sd)</td>
<td>76.3</td>
<td>71.8</td>
<td>59.8</td>
<td>ns</td>
<td>p &lt; 0.01</td>
<td>p &lt; 0.01</td>
</tr>
</tbody>
</table>

Table 2: Two-way analysis of variance with 'skill proficiency' (top) and 'classification' (bottom) as the main factors (Duncan’s post-hoc analysis). Players were classified according to the IWBF and NWBA system. Sub-scores and total score results are shown as percentages, 100% representing the mature skill (ns = not significant; sd = standard deviation).

### Discussion

Assessment of the performance of wheelchair basketball players has been done through the use of skill tests (Brasile 1984,1990; Brasile & Hedrick 1996; Vanlandewijck et al. 1999) or through scouting (Vanlandewijck et al. 1995). The quality of the skills of wheelchair basketball players, however, has never been assessed before. This study tried to develop an observation protocol to assess the quality of the most relevant skills in wheelchair basketball. According to Owen (1982) and Hedrick et al. (1994), the perfection of fundamental individual skills is probably the most significant contributor to success in basketball, wheelchair or otherwise. To ensure that critical and fundamental individual skills are developed, instructional objectives must be identified for individual players (Hedrick et al. 1994). This study aims at providing a tool for trainers and coaches to assess the individual skill proficiency level of wheelchair basketball players in a qualitative way. Furthermore, such a tool might serve classifiers during the classification process to distinguish the untrainable, disability-dependent parameters (actual functional capacity of the players) from the trainable, skill-dependent parameters.

**Intra- and inter-observer reliability**

In order to evaluate the intra-observer reliability of the observation protocol, test-retest trials were conducted with 10 players, distributed over the eight classes (class I - 4.5) and over the three levels (elite, sub-elite, advanced). High correlation coefficients were demonstrated except for dribble (.62). Nevertheless, paired t-test didn’t reveal any test-retest differences, hence it can be concluded that the protocol has acceptable stability.

The same ten players were used to evaluate the inter-observer reliability. High correlation coefficients were found and no significant differences could be detected between the two observers. This indicates that all the performance criteria are clearly stated and that a player is being evaluated in the same way by any observer using the protocol. However it must be noticed that the two observers were real experts concerning this observation protocol. They
developed the protocol and were very familiar with the used performance criteria. It is recommended that in a future study the evaluation of the inter-observer reliability should be done with three observers, who are not involved in the development of the protocol, but need training in using the protocol and its objectives.

The results indicate acceptable internal consistency of the observation protocol. Each sub-score measures a different motor ability (average correlation within the sub-scores), and each sub-score contribute significantly to the total score (high correlation with the total score).

Validity

Looking at the results, as described in table 2, an obvious trend is appearing. Elite players score higher on all sub-scores and on the final score than the sub-elite and the advanced players. The advanced players score all the time lower than the elite and sub-elite players. Between elite and sub-elite players no significant differences were found. That was only to be expected. The players of the sub-elite group were also member of one of the best national teams in the world. All the players of these teams have equal opportunities to train and to improve their skill proficiency level. Nevertheless it seems that the elite players are slightly better, resulting in higher sub-scores and total score. This probably explains why the players of the elite group get more playing opportunities in their team.

The second part of the analysis showed no significant differences (p > 0.05) between classes, when looking at the On sub-scores and at the total score. This is true in using the IWBF- as well as the NWBA classification system. This means that skill proficiency level is not related to functional capacity and that the protocol only measures skill proficiency.

From table 2, it should be noted that even in elite wheelchair basketball players there is room for fundamental skill improvement. In average, the best players in the world only reach 68.6% of a mature ball handling skill (SS1) and 59.6% of mature shooting skills (SS3). To optimize players’ skill proficiency, players must learn the motor patterns required to perform the fundamental skills. In this phase, objective evaluation and instructions are warranted to refine and enhance execution. As the mechanics of the tasks are mastered, players’ understanding of when and how the skills to be used must be refined by introducing increasingly more sophisticated, competitive drills (Hedrick et al. 1994). During this learning process the observation protocol could be a valuable interactive tool for players and coaches.

Conclusions and recommendations

The purpose of this study was to develop an observation protocol which can be used in the training of classifiers to evaluate the skill proficiency level of wheelchair basketball players. After developing the protocol, statistical analysis was done to examine its reliability and validity. The results show that:

- The protocol can be considered as a reliable tool. Stability and inter-observer reliability showed good results. Nevertheless inter-observer reliability should be checked again, using more independent observers who are not related to the development of the protocol.
- The protocol can also be considered valid. Internal consistency was demonstrated and content validity was established. It appears that the protocol is sensitive to skill, without being dependent on functional classification.

It can be concluded that the protocol can be used in the training of classifiers to emphasize the difference between functional potential and skill proficiency. This way, classifiers will only look at functional capacity and the classification of the players will only depend upon untrainable, disability-dependent parameters.

Last, a discriminant analysis should be carried out, to check which performance criteria can be deleted from the observation protocol to simplify it. This way, the protocol can hopefully be used during observation ‘on the court’ instead of video-tape analysis and become a very useful tool for coaches and trainers.
References


Vanlandewijck, Y.C., Spaepen, A.J., & Lysens, R.J. (1995). Relationship between the level of physical impairment and sport performance in elite wheelchair basketball athletes. Adapted Physical Activity Quarterly, 12, 139-150.

Beobachtungsprotokoll zur Befähigungsbewertung beim Basketballspiel männlicher Rollstuhlfahrer

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Abstract

Protocole d'observation en vue d'évaluer la maîtrise des aptitudes au basket-ball masculin en fauteuil roulant

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Abstract

L'objectif de la présente étude consistait à élaborer un protocole d'observation en vue d'évaluer le niveau de maîtrise des aptitudes de joueurs de basket-ball en fauteuil roulant. Une analyse de la littérature et l'observation des meilleurs joueurs de basket-ball en fauteuil roulant au monde ont permis de déterminer des critères de performance pour sept aptitudes spécifiques de déplacement. A l'aide de ces critères de performance, nous avons déterminé le degré d'acquisition d’aptitudes spécifiques du basket-ball en fauteuil roulant chez quarante-huit joueurs à travers l'analyse de leurs jeux enregistrés sur vidéo. L'échantillon comprenait des joueurs d'élite, de sous-élite et confirmés, avec une représentation équilibrée de différentes catégories d’aptitude fonctionnelle. La fidélité par test-retest et inter-examinateurs se situait respectivement entre .62 et 1.00 et entre .88 et 1.00. Les résultats ont également révélé que le protocole présentait une bonne cohérence interne. Par ailleurs, l'analyse de variance à deux facteurs a mis en évidence que le niveau de maîtrise des aptitudes des athlètes, tel que déterminé à l'aide du protocole d'observation, était dépendant du groupe (aptitude) mais non dépendant du handicap (classification), confirmant ainsi la validité du protocole. Nous en avons tiré la double conclusion que 1) le protocole pourrait être utilisé dans la formation des classificateurs pour souligner la différence entre potentiel fonctionnel et maîtrise des aptitudes et 2) qu'il constituerait un outil interactif valable pour les joueurs et les entraîneurs dans leurs efforts d'amélioration du niveau de maîtrise de leurs aptitudes.
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Abstract

The purpose of this study was to develop an observation protocol to evaluate the skill proficiency level of wheelchair basketball players. Review of the literature and observation of world’s best wheelchair basketball players resulted in performance criteria for seven specialized movement skills. Using these performance criteria the maturity of wheelchair basketball specific skills in forty-eight wheelchair basketball players was determined through game analysis from video recordings. The sample consisted of elite, sub-elite and advanced players, with balanced representation from different functional ability classes. Test-retest and inter-scorer reliability ranged from .62 to 1.00 and from .88 to 1.00, respectively. Results also indicated that the protocol had good internal consistency. Two-way ANOVA showed that the skill proficiency of the athletes as judged by the observation protocol was group-dependent (skill) but not disability-dependent (classification), confirming the validity of the protocol. It was concluded that the protocol 1) could be used in the training of classifiers to emphasize the difference between functional potential and skill proficiency, and 2) would be a valuable interactive tool for players and coaches in the process of skill proficiency enhancement.