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# Planning and Monitoring Training Loads During the Competition Phase in Team Sports

Vincent G. Kelly
South Sydney Rabitohs, Redfern, Australia
Aaron J. Coutts, PhD
School of Leisure, Sport, and Tourism, University of Technology, Sydney, Australia

**summary**

The training and match demands in the competition phase in team sport can vary dramatically depending on the quality of opposition, the number of days between games, and match location. The simple model described in this article can be used to predict the match difficulty and guide the prescription of future training loads during the in-season training phase in team sports.

## Introduction

Periodization offers a framework for planned and systematic variation of training parameters with the goal of optimizing training adaptations specific to a particular sport (9). In team sports, the typical model of periodization will include the following phases: general preparation, specific preparation, precompetition, and competition (5). A common problem for coaches is determining the appropriate training loads to prescribe during the competition phase of the season. Factors such as the quality of the opposition, the number of training days between matches and any travel associated with playing away games all influence the between-match periodization of training loads. We suggest that a combination of these factors can be used to guide planning of the between-match weekly training loads. For example, a team preparing for a difficult match (i.e., strong opposition, little preparation time, and significant away travel) may plan a light training week so that any residual fatigue is minimized. Conversely, a home game against weaker opposition with several days between games may provide an opportunity to have an increased training load to improve the player's fitness levels.

Cormack (2) developed a periodization model for an Australian Rules Football League team based on the number of training days between matches and the effect of interstate travel. In this previous paper, several examples of how the training week (microcycle) can be manipulated to allow optimal recovery, while also allowing the development and refinement of the ongoing technical and tactical requirements for team sports were provided (2). It was also suggested that the success of an in-season periodization plan is affected by several factors, including the skills / technical coaches' understanding of the training process, the measurement and prescription of the volume and intensity of skill training sessions, and the balance between training, rest, and recovery.

Quite often the challenge of the strength and conditioning coach is to educate the skills coach and athletes on the intricacies of a detailed periodized plan. The tendency of many skills coaches is to react to the situation or coach using intuition rather than following a specific plan (2). Furthermore, it has also been shown that the training loads that have been planned to be completed by the coach are often poorly executed by the athlete (8). For example, Foster et al. (8) reported that athletes often complete high-intensity training sessions at lower intensities than coaches intend and they often complete lower-intensity recovery sessions at higher intensities than initially planned. These findings suggest that either many coaches are not implement-

ing their training programs according to intention or that athletes are unable to control their training intensity according to coaches' instructions. Regardless of the cause, this mismatch in perception of training between athletes and their coaches may result in suboptimal performance. Due to this, it seems that it is necessary to develop a training monitoring system that allows coaches to plan and monitor the workloads undertaken by their athletes. From a practical perspective, this system should also be simple to understand and easy to implement in a team environment.

The session–rating of perceived exertion (RPE) model developed by Foster et al. (7) is a simple system for strength and conditioning coaches to monitor the load of several different modalities of training (technical, tactical, endurance, speed, and strength). With this system, players are required to provide an RPE for each exercise session that is then multiplied by the training session duration (min) to determine training load. The simplicity of this system makes it effective for quantifying training load in team sports.

The purpose of this paper is to offer an example of a simple system that can be used to guide in-season training loads in team sports. This paper will outline a model that can be used to predict match difficulty and also use the session-RPE system to guide the training process in team sports. We will also present an example from a semi-professional rugby union team as a case study to show how training loads and match difficulties can be monitored throughout the season to guide the coaches with their training periodization.

## Overview of the System

When developing an in-season (i.e., competition phase) training program it is important to have a simple system that allows the coach to predict the difficulty of each match, plan the weekly training load accordingly, and review the program on a regular basis. Figure 1 illustrates how this simple system works.

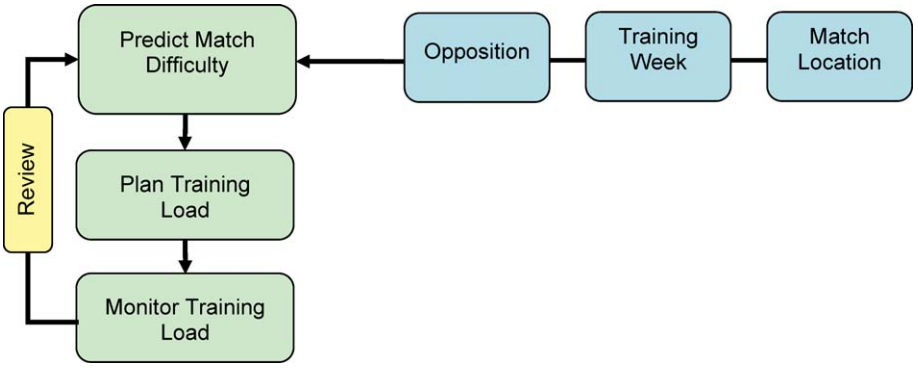


**Figure 1.** A diagrammatic representation of the system.

- Step 1. Predict the difficulty of each match.
- Step 2. Plan the weekly training load.
- Step 3. Monitor the actual weekly training load.
- Step 4. Review and return to step 1.

Each step in this system is discussed in detail below.

## Predicting Match Difficulty

Before the commencement of the season the coaching staff should determine the level of difficulty for each match of the season by calculating the sum of 3 factors. These factors are level of opposition, training days between matches, and match location.

Level of opposition has the greatest effect on match difficulty followed by training days between matches and match location. Therefore, the score for level of opposition is greater than the score for training days between matches which is greater than the score for match location.

### *Level of Opposition*

Prior to the commencement of the competition, each team, including the team you are working with, is ranked from strongest to weakest and given a score based on their rank. For example, the best team in the competition is ranked first and receives the highest level of opposition score, and the team ranked last in the competition receives the lowest score. During the competition phase, the coaches reassess the opposition at the start of each week, and a new rank is determined. The new rank is based on the results of the previous round. This in turn may or may not affect the original match difficulty figure for that week.

Table 1 shows an example of scores for level of opposition in a 10-team competition. These scores can be adjusted for different numbers of teams in the competition.

### *Training Days Between Matches*

It is common in team sports for the matches to be conducted over the weekend (i.e., from Friday night until Monday night). The number of days between matches may vary between 4 and 8 days, which may have a significant impact on the team's preparation. A sliding scale has been prepared to allow for these differences, and scores are allocated for each different number of days between matches (Table 2).

### *Match Location*

Match location can have an impact on the weekly training load. Scores are allocated for home and away matches. Additional points can be added if the team is required to travel significant distances

**Table 1**
**An Example of Categories and Scores for Level of Opposition in a 10-Team Competition**

| Factor | Score |
|---|---|
| Top 4 teams | 12–9 |
| Middle 3 teams | 8–6 |
| Bottom 3 teams | 5–3 |

**Table 2**
**An Example of Categories and Scores for 4–8 Training Days Between Matches**

| Factor | Score |
|---|---|
| 4 days | 8 |
| 5 days | 6 |
| 6 days | 4 |
| 7 days | 2 |
| 8 days | 1 |

**Table 3**
**Categories and Scores for Match Location**

| Factor | Score |
|---|---|
| Away with travel | 3 |
| Away | 2 |
| Home | 1 |

and spend time away from their usual environment (Table 3).

### *Match Difficulty Calculations*

After the scores for each factor are determined each opposition team is given a total score. This score is used to represent how difficult the coaches predict the matches may be. This task should be performed at the start of each new week.

Table 4 shows an example of the scores for each factor and the total score representing match difficulty as calculated at the start of the season. In this example, there are 10 teams in the competition,

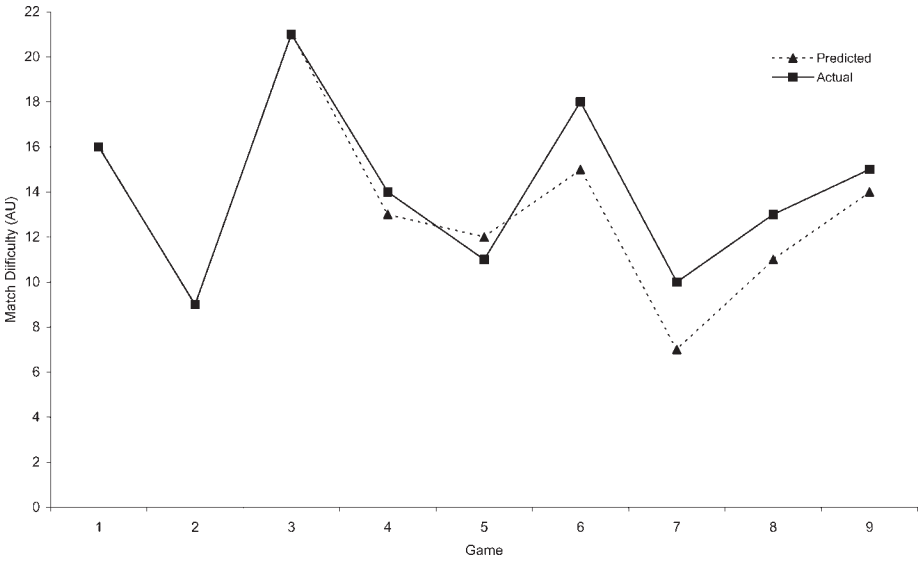


**Figure 2.** An example of predicted and actual match difficulty throughout a season.

between 4 and 8 days between matches, and 1 "away" match with travel.

## Training Load

### *Intensity and Volume*

The training intensity for each session is calculated using the modified Category Ratio-10 RPE scale described by Foster et al. (7). Players are asked to rate how difficult the entire session is on a scale of 1 to 10 using a modified RPE scale (Table 5). These measures are taken after approximately 30 min of the completion of training. We have found that athletes of all levels can use the RPE scale reliably once they have been anchored using standard methods (1). The training volume is quantified using total training time (min).

### *Load*

The volume (minutes) is multiplied by the global intensity (RPE) to determine training load for all individual sessions. A simple example where training sessions are held twice weekly is shown in Table 6, the training loads from these sessions are added to provide the weekly training load.

### *In-Season Match Difficulty*

In-season periodization in team sport is an ongoing process and the level of opposition is a key factor in estimating match difficulty. As the season progresses, teams performing better or worse than expected have an impact on the match difficulty. Figure 2 shows a case study of a season where the actual match difficulty was greater than the predicted match difficulty. Interestingly, this pattern appeared towards the end of the season. In this example, the opposition performed better throughout the season than the coaching staff had initially expected. At the start of the season, the coaches had initially planned for these matches to be less difficult; however, by using the current model the coaches were able to reassess the level of opposition on a weekly basis. The readjusted match difficulty scores were used by the coaches and strength and conditioning staff to adjust their training plans to ensure optimal preparation for each match.

## In-Season Training Load

### *Predicted Versus Actual Training Load*

The monitoring of training loads is important for coaches to determine if they are implementing training stress according to their plan (3, 4, 8, 11).

**Table 4**
**An Example of Scores for Each Factor and Total Match Difficulty for Each Team**

| Opposition | Level | Days | Location | Total |
|---|---|---|---|---|
| Team 1 | 11 | 4 | 1 | 16 |
| Team 2 | 3 | 4 | 2 | 9 |
| Team 3 | 12 | 6 | 3 | 21 |
| Team 4 | 10 | 2 | 1 | 13 |
| Team 5 | 7 | 4 | 1 | 12 |
| Team 6 | 5 | 8 | 2 | 15 |
| Team 7 | 4 | 1 | 2 | 7 |
| Team 8 | 6 | 4 | 1 | 11 |
| Team 9 | 8 | 4 | 2 | 14 |

Note: There is no score of 9 under level of opposition. In this example, the coaches rated their own team fourth at the start of the season, which represented a score of 9 points.

**Table 5**
**The Modified Rating of Perceived Exertion Scale Used for Athletes to Classify Their Perceived Intensity of Each Training Session (7)**

| Rating | Descriptor |
|---|---|
| 0 | Rest |
| 1 | Very Easy |
| 2 | Easy |
| 3 | Moderate |
| 4 | Somewhat Hard |
| 5 | Hard |
| 6 | |
| 7 | Very Hard |
| 8 | |
| 9 | |
| 10 | Maximal |

Recent studies have shown that the session-RPE method compares favorably with more complicated and invasive methods for monitoring training loads in athletes (4, 6, 10, 12). For example, several studies have shown a significant relationship between session-RPE training load and various heart rate–based methods of monitoring training load in team sports such as basketball (6), soccer (10), and rugby league (4). Moreover, Sweet et al. (12) also reported a high agreement between session-RPE and weightlifted (% 1 repetition maximum [1-RM]) during a range of resistance training sessions. Due to the favorable relationships between these methods for quantifying training in various exercises, we suggest that the model presented in this paper is a simple and inexpensive system that strength and conditioning coaches can use to monitor and guide the training process.

Using this method, the session-RPE system is applied in a team-sport setting and training loads are both monitored and predicted in an attempt to better guide in-season training. Each week the staff can examine the amount of training performed in the previous week combined with the new match difficulty score for the following week. They can then reassess their training plan to allow for any changes to the original plan. Figure 3 provides an example of planned and actual training loads throughout a season. In this case, the actual training load was greater than the predicted load in the week of Game 1. The coaches adjusted their training sessions for the following week to account for this difference and the actual training load was slightly less than what had originally been planned.

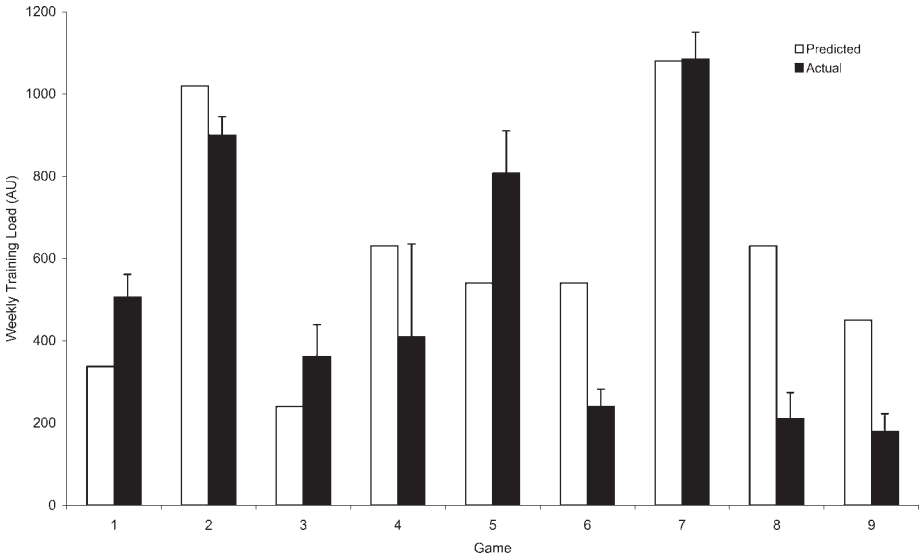


**Figure 3.** An example of predicted and actual weekly training loads throughout a season.

**Table 6**
**An Example of Total Training Load for a Typical Week In-Season**

| Day | Average RPE | Session duration (min) | Training load |
|---|---|---|---|
| Tuesday | 4.9 | 120 | 589 |
| Thursday | 4.7 | 105 | 496 |
| Weekly Load | | | 1,086 |

RPE = rating of perceived exertion.

## Match Difficulty and Training Loads

The predicted level of difficulty of a match is used to determine the training load for the week. In general, the training load will be decreased for a more difficult match and increased for a less difficult match. Figure 4 shows an example of this relationship. In this example, the predicted match difficulty is low for the second game of the season; therefore, a week of greater training load is planned. Conversely, the third game of the year has a high predicted match difficulty, and a reduced training load is planned for that week. It is interesting to observe that this approach to training resulted in undulating, nonlinear periodization of training loads (see Figure 4). This periodization model is in agreement with the previous literature that suggests that nonlinear, undulating training models are more common during the in-season period in team sports (4, 7).

Often skills/technical coaches have a tendency to prescribe longer training sessions in the lead-up to important matches, believing the players will benefit from the extra training. Using this method, the strength and conditioning coach can provide feedback to the skills coach to demonstrate the effect extra training may have on recovery and performance. This will ensure the team maintains optimal fitness levels leading into the finals matches and, therefore, allow for a taper-like reduction in training loads during the finals period.

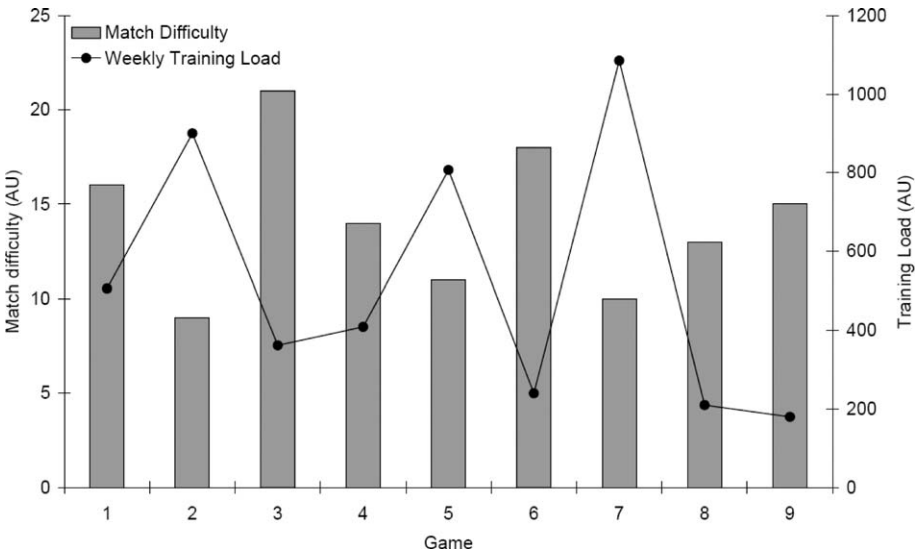


**Figure 4.** Match difficulty versus total weekly training loads. AU = arbitrary units.

## Conclusion

Several factors influence the periodization of training loads during the competition phase in team sports. The simple method described in this article can be used to predict the difficulty of each match by examining the level of the opposition, the number of days between matches and the match location. Using this method in a variety of team sport competitions will provide the strength and conditioning coach with a greater understanding of in-season periodization. In order to achieve this, we suggest that session-RPE should be monitored in all training sessions including strength-training sessions, conditioning sessions, and tactical and technical training sessions to provide a global rating of training load. The strength and conditioning coach can use this information to determine the in-season training loads and monitor these factors throughout the season to ensure the team's optimal physical preparation. ♦

## References


1. Borg, G. *Borg's Perceived Exertion and Pain Scales*. Champaign, Illinois: Human Kinetics, 1998. pp. 44–53.
2. Cormack, S. The effect of regular travel on periodisation. *Strength Cond. Coach*. 9:19–24. 2001.
3. Coutts, A.J. Monitoring training in team sports. *Sports Coach*. 24:19–23. 2001.
4. Coutts, A.J., P.R.J. Reaburn, A.J. Murphy, M.J. Pine, and F.M. Impellizzeri. Validity of the session-RPE method for determining training load in team sport athletes. *J. Sci. Med. Sport*. 6:525. 2003.
5. Dawson, B. Periodisation of speed and endurance training. In: *Training for Speed and Endurance*. P.R.J. Reaburn and D.G. Jenkins, eds. Sydney, Australia: Allen & Unwin, 1996. pp. 76–96.
6. Foster, C., J.A. Florhaug, J. Franklin, L. Gottschall, L.A. Hrovatin, S. Parker, P. Doleshal,

and C. Dodge. A new approach to monitoring exercise training. *J. Strength Cond. Res.* 15:109–115. 2001.
7. Foster, C., L.L. Hector, R. Welsh, M. Schrager, M.A. Green, and A.C. Snyder. Effects of specific versus cross-training on running performance. *Eur. J. Appl. Physiol.* 70:367–372. 1995.
8. Foster, C., K.M. Helmann, P.L. Esten, G. Brice, and J.P. Porcari. Differences in perceptions of training by coaches and athletes. *SASMA*. 8:3–7. 2001.
9. Gamble, P. Periodization of training for team sport athletes. *Strength Cond. J.* 28:55–56. 2006.
10. Impellizzeri, F.M., E. Rampinini, A.J. Coutts, A. Sassi, and S.M. Marcora. The use of RPE-based training load in soccer. *Med. Sci. Sports Exerc.* 36:1042–1047. 2004.
11. Impellizzeri, F.M., E. Rampinini, and S.M. Marcora. Physiological assessment of aerobic training in soccer *J. Sports Sci.* 23:583–592. 2005.
12. Sweet, T.W., C. Foster, M.R. McGuigan, and G. Brice. Quantitation of resistance training using the session rating of perceived exertion method. *J. Strength Cond. Res.* 18: 796–802. 2004.
13. Wathen, D., T.R. Baechle, and R.W. Earle. Training variation: Periodization. In: *Essential of Strength Training and Conditioning*. T.R. Baechle and R.W. Earle, eds. Champaign, IL: Human Kinetics, 2000. pp. 513–527.

**Kelly**

**Vincent Kelly** is the Head Strength and Conditioning Coach for the South Sydney Rabitohs in the National Rugby League.

**Coutts**

**Aaron Coutts** is a Senior Lecturer in Sport and Exercise Science at the School of Leisure, Sport, and Tourism within the University of Technology, Sydney.