POSTER PRESENTATION

How it started

CROSS-TRAINING IN talent development

MAIN MESSAGE
* coaches are unfamiliar with cross-training
* how to select a donor sport?
* guidelines for coaches

POSITIVE EFFECTS
* reducing injuries
* reducing drop-outs
* enjoyment
* positive transfer

TO CONSIDER
* awareness of benefits
* time & amount
* improvement vs. fun

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An ongoing discussion in the area of talent development is whether young athletes have to focus on one sport to be able to become an elite player. The Developmental Model of Sport Participation has shown two perspectives on reaching an elite performance level [1]. One perspective is early specialization, whereby the coach trains athletes who participate in one main sport with little or no involvement in other sports. The athletes specialize already in the early to middle childhood [2]. The coach will focus mainly on improving performance in the athletes. Research has shown a relationship between the number of practice hours and the years of commitment to sports performance and introduced the ‘10,000 hours’ rule for achieving expertise in a particular skill set: at least 10,000 hours of deliberate practice in a ten year period [3]. If the athletes specialize early, the 10,000 hours of practice and the 10-year commitment in the main sport can be reached more easily. However, it has been shown that excessive training during early specialization leads to more serious injuries in youth [4]. Additionally, there are more disadvantages in early specialization such as reducing intrinsic motivation, a higher dropout rate and even burnouts among young athletes [5]. The second perspective, in which several coaches train an athlete because he or she is involved in a number of different sports before specializing in a main sport, is called early diversification [6]. Athletes who are exposed to a variety of sports will experience different physical, cognitive, and psychosocial environments which leads to a positive development of physical, cognitive and social skills [4; 7]. The coach of these athletes will focus more on fun, success, and pleasure, which has a positive effect on intrinsic motivation as well [1]. Intrinsically motivation is required when an athlete specializes in a sport at a later stage because structured and effortful training sessions are needed [8]. Therefore, the amount of dropouts is lower for athletes who did early diversification compared with athletes who specialized already at a young age.

Guido van Weeren was active as a trainer in athletics and head coach of the talent center Noord-Nederland in The Netherlands for approximately 15 years. Since August 2019, Guido is involved as a performance coach of FC Groningen, where he supervises the physical training sessions for the youth. He also gives workshops in which he shares his enthusiasm and stories about life as a coach.
Early diversification is in line with the Athletic Skills Model (ASM) in which they suggest that children first have to acquire basic movement skills before they specialize themselves as an athlete [9]. Although early diversification has different advantages for athletes, there is a reduced involvement in different sports around the age of 12-15 years old due to specialization in the main sport [2; 4]. The phase described for 12 years and older in the ASM focuses less on learning new complex movement skills and more on re-execution of already known movement skills in different situations [9]. Therefore, coaches can use different sports during the specialization phase to train sport specific skills in different environments.

The integration of different sports is the concept of cross-training. This is a training design in which athletes are specializing in a main sport but their training program also involves other sports [10]. A result of cross-training is the improvement of skill development and is based on the transfer of movement skills. Studies have shown that athletes can transfer elements of skills across different sports [4; 11]. These elements are categorized into movement, perceptual, and conceptual elements[12]. Sports with similar biomechanical and anatomical actions share movement elements, such as throwing a baseball overhand and an overhand serve in tennis. Perceptual elements are based on the information from the environment which athletes use to make performance decisions. For example, field hockey and soccer share perceptual elements because both sports require athletes to interpret the actions of their opponents in order to be successful.

Experience from and practice in one sport can promote or inhibit successful performance in another sport. This is called positive or negative transfer respectively. It is also possible that a certain sport has no impact on the skills used in the main sport, this is called zero transfer. Positive transfer is advantageous and this is where the concept of donor sports comes into play. Donor sports contain the same basic movement skills as the main sport and practicing the donor sport contributes to the level of expertise in the main sport [13]. Therefore, cross-training uses donor sports to enable athletes to learn and practice the same basic movement skills that are used in their main sport. Cross-training should be implemented during the specializing years, that is, before the athletes enter the investment years [14]. In this case, the athlete has the advantage of cross-training on one hand but does not lose the time needed for investment in the main sport on the other hand. Van Weeren is a coach involved in athletics and soccer with a focus on talent development and topsport. He supports the integration of cross-training during the specialization phase. According to him, the investment years are needed to focus on improving specific skills in the main sport, such as sprinting speed or strength. Note that the age in which athletes enter the investment years differs between sports, depending on the peak performance age of the main sport. Performance enhancement is interesting for coaches but cross-training gets even more interesting with the knowledge that it is also effective for the prevention of injuries and dropouts.
When participating in one sport only, muscles are continuously used in the same pattern. By doing multiple sports, different muscles are used in different ways, which takes some of the stress away and enables a more developed strength throughout the whole body [9; 15; 16]. Additionally, practicing multiple sports accounts for a reduced amount of dropouts because it prolongs engagement [17]. Although, these advantages are interesting for coaches and athletes, van Weeren mentioned the importance of keeping track of the load that athletes experience by doing an extra sport. He proposed to do a training session in another sport instead of a training session planned in the main sport.

Based on literature, we can conclude that cross-training has positive effects on talent development in the main sport. However, this design is rarely implemented in practice. This may be because coaches are not familiar with cross-training, have a lack of knowledge about the benefits or how to implement this concept in practice. Van Weeren told us that these assumptions are right. On top of that, even when coaches know about the existence of cross-training, they have to be able to defend the choices they make regarding the training program to the athletes, their parents, the club, the sponsors, and the media. For that reason, a coach needs certainty of the benefits and scientific argumentation before they are willing to integrate cross-training. Therefore, the coach needs to be provided with information and guidelines about cross-training. A leaflet with information and a simple scheme displayed on it can serve as a bridge. Although cross-training is possible for all sports, in this article, we will provide the coach an example of a scheme for field-hockey. The scheme is shown in Figure 1. During the development of this scheme, we focused on specific skills needed when playing field-hockey. We divided the skills into the performance characteristics (e.g. physiological) that an athlete needs to develop to become a talented athlete [18]. These skills are sprinting speed and endurance (physiological), dribble skills, shooting accuracy, and agility (technical), decision making and positioning in ball and non-ball possession (tactical) [19; 20]. As a coach, you want to know which donor sport you can choose to make your athletes better in a specific skill. Therefore, the scheme contains arrows that point from a needed skill in hockey to one or multiple donor sports that can be done to improve that skill. For example, for improving hand-eye coordination (agility), the athletes can practice other striking sports, such as softball [21].

<table>
<thead>
<tr>
<th>Physiological skills</th>
<th>Technical skills</th>
<th>Tactical skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprinting speed</td>
<td>Endurance</td>
<td>Positioning</td>
</tr>
<tr>
<td>Endurance</td>
<td>Agility</td>
<td>Decision making</td>
</tr>
<tr>
<td>Agility</td>
<td>Dribble skills</td>
<td>Soccer, handball, basketball, lacrosse, double-tennis</td>
</tr>
<tr>
<td>Dribble skills</td>
<td>Shooting accuracy</td>
<td>Baseball, lacrosse, golf, (table) tennis, curling, badminton</td>
</tr>
<tr>
<td>Shooting accuracy</td>
<td></td>
<td>Karate, boxing, handball, basketball, soccer, badminton</td>
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</tbody>
</table>

**Figure 1.** The back of the leaflet with a scheme of donor sports that have a positive transfer of skills for sport-specific field-hockey skills.
Additionally, information about the amount of time that has to be invested in the donor sport before actual improvement can be seen in field-hockey performance, is included in the scheme. This is a useful addition, according to Van Weeren. He is practicing two different sports with boys U15 (rotating between judo, gymnastics and dance) for both half an hour per week. With this amount of training hours, he notices an improvement in skills that are useful in soccer.

The front of the leaflet, displayed in Figure 2, contains basic information about cross training, so you can refresh your memory and use it to inform other coaches that are not familiar with the cross-training yet. The benefits for the athletes are mentioned as well as statements about the reduced risk of injuries, less dropouts, and the positive transfer of movement skills. There is a digital version of the leaflet as well for easy distribution among other coaches. When a coach is interested in using cross-training, he or she can send an email to a coordinator. In this way, a network of nearby sport clubs can be formed and it is easier to arrange training sessions at other sport clubs. According to van Weeren, it is important that training sessions are given by someone who is trained in the donor sport to give a higher level of the sessions.

To actually bring cross-training to the attention of coaches and hand out the leaflet, meetings are organized with coaches from different clubs from the region. These meetings also contribute to the network of nearby sport clubs. By introducing cross-training to the coaches and giving them guidelines to work with this concept in practice, we hope to make a contribution to talent development. And therefore, cross-training should no longer be ignored so athletes will get better and not be bored.
References