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The effects of non-specific and specific concepts on tactical creativity in team ball sports

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Abstract
The main aim of this study was to examine the efficacy of various training approaches in team ball sports for the development of tactical creativity. Altogether, 135 children aged about 7 years took part in a 15-month field-based study. They participated either in non-specific treatment groups, a specific handball, soccer or field hockey group, or a control group. General and game-oriented tactical creativity were chosen as outcome measures. Our analysis of treatment-related effects showed that the non-specific groups displayed improvements in general creativity, whereas the specific groups showed improvements in the game-oriented creativity in which they were trained. Furthermore, clear transfer-related effects were observed. The analysis of group-related effects indicated no differences between the approaches. Only the soccer-specific group performed better in nearly all creative values. In conclusion, a non-specific concept appears to be a promising alternative to traditional specific treatments. This is further substantiated by several pedagogical, psychological, and medical arguments.

Keywords: *Invasion Games, tactics, divergent thinking, teaching games for beginners, deliberate play*

Introduction

Many studies have compared two instructional concepts for teaching team ball sports: a *technical* and a *tactical* approach (e.g. French, Werner, Rink, Taylor, & Hussey, 1996; Rink, French, & Graham, 1996; Turner & Martinek, 1992). Numerous dependent variables have been used, including skill acquisition, decision making, declarative and procedural tactical knowledge, and general game performance (for a review, see Holt, Strean, & Bengoechea, 2002). Regardless of the measurements taken, the results tend to be similar and it would appear that a combination both of technical and tactical learning offers children and students the best opportunity in sports games (e.g. Lawton, 1989; Turner & Martinek, 1992). As Holt *et al.* (2002, p. 164) pointed out in many concepts, ''skill development is explicitly included in tactical approaches, just as games play is a part of technical approaches''.

Another important topic concerns the *transfer* of learning between different games. Recent research indicates that such a transfer exists in net games, especially the transfer of tactical abilities (e.g. Jones & Farrow, 1999; Mitchell & Oslin, 1999). Yet little research has been conducted so far in the field of team ball sports (e.g. French & Thomas, 1987; Nevett, Rovegno, Barbiarz, & McCaughtry, 2001). One aim of this study was to determine whether *non-specific* or *specific* concepts are more successful in teaching team ball sports. Is a broad curriculum that includes different kinds of sports game more advantageous to beginners than traditional specific concepts (handball, soccer, field hockey)?

Another central idea of this study is that the teaching of ball games and the measurement of its success should focus on relevant competencies that cannot much be improved upon in later training phases. In sports games, this especially concerns *tactical creativity*. ''Creative'' refers to those varying, rare, and flexible decisions that play an important role in all team ball sports. Many psychological studies have shown that creativity has to be learned and stored early on in life (for a review, see Milgram, 1990). After childhood, the influence of training becomes weaker (cf. Roth, 2004). Therefore, different concepts for beginners are evaluated with tactical creativity as an outcome measure. We are unaware of any other study in this area that has used this criterion for success.

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In accordance with Rink (1996), who called for the use of long training programmes in experimental settings, a third feature of the present study is that the interventions evaluated are performed over a considerably longer period than normal. In most published studies, the treatments lasted only between six and thirty lessons, each of about 45 min duration (see French *et al.*, 1996; Gabriel & Maxwell, 1995; Mitchell, Griffin, & Oslin, 1995; Turner & Martinek, 1992). The problem with such short-term training programmes is that they do not always lead to significant improvements in performance. It is clear that this danger is increased by selecting creativity as the dependent variable. Creativity develops much more slowly over time (cf. Roth, 2004) than technical skills or other tactical abilities, such as perceptual, anticipatory, and decision-making competencies (game intelligence).

In this study, we hope to enrich the debate by offering a new framework for research and discussions on the analysis and teaching of ball games. More specifically, we wish: (a) to present the independent variable of non-specific concept as an important aspect in the methodological debate; (b) to identify both general and game-oriented tactical creativity as understudied dependent variables; and (c) to evaluate concepts in ball games over a long period of time.

Theoretical background

A non-specific concept of teaching team ball sports

Many clubs have ''mini-groups'', as in handball and soccer. Here children are trained in one specific game before they even learn to play. The ''culture of playing in the streets'', which could be called the ''natural ball school'', has largely disappeared from our society. A non-specific concept of teaching team ball sports offers novices a natural and play-oriented ''upbringing'' where the aims, contents, and methods focus on an unspecific, basic training with different balls. The child should experience a wide range of sport situations. Playing is given top priority, as it is the central focus of the teaching invasion game approach (cf. Griffin, Mitchell, & Oslin, 1997). As Côté and Hay (2002) suggested, the sampling years (ages 7 – 12) are characterized by a low frequency of deliberate practice and a high frequency of deliberate play. Self-determination theory and Vallerand's recent hierarchical model of motivation in sport support the notion that early deliberate play has a positive effect on intrinsic motivation over time (cf. Ryan & Deci, 2000; Vallerand, 2001).

A non-specific programme allows children to acquire experience in games via diversified sports game training, which allows them actively to take part in several sports games and to perform successfully in different game situations (cf. Côté, Baker, & Abernethy, 2003). Unpublished studies by the second author show that gathering games experience in several different sports games is an ideal medium for the creative development of players. Children still profit from the varied experiences and perceptions of situations in sports games gathered during their childhood (see also Baker, Côté, & Abernethy, 2003). Not only did they learn many techniques, such as throwing, catching, and kicking, but they also solved different tactical situations (with different group sizes, rules, ball materials) on their own before learning and acquiring certain tactical features. This view is supported by concepts in the current literature (cf. Baker, 2003; Baker *et al.*, 2003; Côté *et al.*, 2003; Wiersma, 2000).

Creativity

It is widely accepted that gathering games experience over several years through a type of ''tactical and motor brainstorming'' is an ideal medium for the development of creativity. This is supported by models from the literature on creativity, especially current multi-theoretical approaches (see Sternberg, 1999; Sternberg & Lubart, 1995), and by empirical evidence from research on general creativity-related context variables. To measure tactical creativity in sports games, the two constructs of originality and flexibility (= divergent thinking) identified through factor analysis by Guilford (1967) were used. [The third central criterion for creativity identified by Guilford (1967) is fluency of thinking. It is defined as the number of adequate solutions to one given situation produced by an individual. This criterion is not measurable in actual game situations and could only be determined by interviews in settings with low external validity.] At the behavioural level, originality and flexibility are defined as follows:

- *Originality:* This criterion of creativity denotes the unusualness, innovativeness, statistical rareness, or even uniqueness of tactical solutions to a sports game-related task.
- *Flexibility:* This criterion of creativity characterizes the ease with which someone changes between thought levels, uses other systems of reference, generates different hypotheses, and modifies information. It is measured via the diversity of tactical solutions over different game situations.

For the purpose of the present study, it was necessary to monitor creative behaviour (originality, flexibility) in situations that required various motor skills. In this way, we have constructed standardized game situations, in which the participants initially act with their hands, then with their feet, and finally with

a hockey stick. Consequently, three dependent variables were measured for each individual: handball-, soccer- and hockey-oriented creativity (game-oriented creativity values). These can be added together to form a *general creativity* value (all results generated with the hand, foot, and hockey stick). More specifically, the following questions were addressed:

- How has the creative development of the children progressed in the different fields in which they are trained? Do the non-specific groups improve in terms of general creativity and the specific groups in their respective game-oriented creativity (treatment-related effects)?
- To what extent do transfer effects occur beyond the treatment-related effects? While the non-specific groups are to be assessed for changes in their game-oriented creative performance, the question arises for the specific groups as to whether their creative performance also improves for the other sports games (transfer-related effects)?
- To what extent is the creative performance furthered in different ways by the various treatments? Are non-specific or specific concepts more effective (group-related effects)?

Methods

Participants

Altogether, 239 children (80 girls, 159 boys) participated in the field study (mean age 6.9 years, $s = 0.83$). Not all children spent the whole period of time in the treatment groups. The number of children decreased for several reasons (e.g. relocation to another town). At the end of the study, 135 children took part in all measurements. There are no differences in length of participation in training between the non-specific and specific groups. The non-specific groups trained for 120 min per week and the specific handball, soccer, and field hockey clubs for a mean of 90 min. Considering the time that the specifically trained children spent participating in competitions outside the regular training programme, there are no essential differences in the length of practice. It is important to note that the covariables of experience in sports games, participation in training or leisure activities, and length of training had no influence on the results. This was checked using analyses of covariance.

Treatment

All participating instructors for the non-specific and specific groups were well educated and had specific teaching licences and qualifications. The trainers of the non-specific group had been specially trained for the programme, in so far as all the games and exercises were introduced to the trainees and they were obliged to teach these in a given way. The content of the specific treatments was ascertained following the field study through interviews with the trainers. In addition, during the treatment phase, the experimenters sometimes visited the training sessions anonymously to get an overview of how the various groups trained. None of the instructors were informed about the purpose of the study, the tests or the anticipated outcomes.

Non-specific treatments ($n = 50$). The children undergoing non-specific treatments attended the standardized training programme of Roth (2004). [The non-specific concept for teaching team ball sports of Kröger and Roth (2005) is already available in book format in German, Spanish, Portuguese, and Hungarian.] The non-specific concept was organized in the Heidelberg Ball School twice a week (60 min). In brief, the curriculum is constructed around three main forms of access and follows the philosophy of playful and broad basic training for sports games. First, the ''playful situation-oriented'' means of access includes non-specific tactical components that are important for many ball games. Examples include identification of gaps (e.g. opportunities for passing or shooting), finding and using free space, and spatial orientation. Second, the ''ability-oriented'' means of access imparts non-specific components of ball coordination. For example, the children learn in a general way to coordinate game techniques under time-pressure, or they work on combining moves that they have already mastered. Third, using the ''skill-oriented'' means of access, children are trained in elementary, non-specific components of techniques that are a part of many sports game skills, such as recognizing the flight curve of the ball or determining the point of contact (e.g. hitting, shooting) with the ball. In total, 3×7 basic tactical, coordinative, and technical components form the content of the non specific concept.

Based on these three forms of access, many games and exercises were constructed in which children use different balls (e.g. handball, football, basketball, tennis ball) and different parts of the body. The format of the lesson always consists in of using hand, foot, and hockey stick for the same length of time. All games and exercises were given to the instructors and they were obliged to teach them in the defined way. The children did not take part in any competitions.

After 6 months, the children in the non-specific training programme were divided into three slightly more specific groups: non-specific handball ($n = 12$), non-specific soccer ($n = 17$), and non-specific field hockey ($n = 14$). Selection into the three groups was

based on the judgement of the instructors. Because they had monitored the children's performances over a long period, they were in a position to make the best choice. All lessons still followed the curriculum set out by Roth (2004), although the children spent more time playing using special skills. For example, the non-specific handball group played for 60% of the lesson with their hands and only 20% each with foot and hockey stick. Naturally, the exercises for all groups became more difficult.

Specific treatment: Handball (n = 21). The children at the handball clubs received mainly skill-oriented lessons aimed at learning throwing, catching, dribbling, and passing techniques. The skills were always trained in handball-specific mini-games. Instructors paid a lot of attention to the correct execution of the skills. Furthermore, the children learned only a few handball-specific tactical components, such as ''playing together''. No position-specific exercises were given to the children and they only occasionally trained in real handball game situations such as 6 vs. 6. The children regularly took part in competitions.

Specific treatment: Soccer (n = 32). The soccer teams started with non-specific training exercises and played a free soccer game for 30 min at the end of each lesson (7 vs. 7). For the remainder of the time they were taught technical skills, such as passing, stopping, shooting, and dribbling. They initially practised in simple conditions and then later in more complex exercises (e.g. 4 vs. 4). Tactically oriented games were also given to teach ''playing together'' and ''off-the-ball movements''. No position-specific exercises or drill training was provided. The children regularly took part in competitions.

Specific treatment: Field hockey (n = 23). All training lessons were structured in the same way. The field hockey teams started with coordination exercises and mini-games. For the remainder of the time they practised field hockey-specific skills, such as how to handle the stick or the ball. They also learnt how to dribble, push-pass, and control the ball. At the end of training sessions, they often played a field hockey game (6 vs. 6) with modified rules. The children regularly took part in competitions.

Control group (n = 20). The children participated only in the school sports programme twice a week. No child was a member of a special club.

Instrumentation

''Behavior turns out to be much more context-dependent and knowledge-dependent than we used to think. What subjects do in cognitive experiments is often not representative of what they would achieve in other, more familiar settings'' (Neisser, 1994, p. 227). In accordance with this argument, a new procedure called ''game test situation'' (GTS) was developed to assess the creativity parameters (Memmert, 2006). This instrument contains a context-dependent real-world setting that can provoke tactical behaviour directly in valid situations. The idea of the game, number of players, rules, and environmental conditions are completely fixed and standardized. The two game test situations used in the present study were constructed in such a way that each repeatedly presented one basic tactical task – off-the-ball movement (orienting and supporting; GTS1) and identification of gaps (GTS2) – that should be solved by the children in a creative manner. In GTS1, the attackers 1, 2, and 3 endeavour to pass the ball among themselves as often as possible without the defenders 4, 5, and 6 taking possession of the ball. In GTS2, the attackers 1, 2, 7, and 8 have the task of playing the ball beyond the defenders 3, 4, and 5 and below the upper limit into the opposite field. The children use three kinds of skill (hand, foot, and hockey stick) in a system where the positions of all players (including opponents) are systematically varied (two rounds for each person). Both game test situations were examined for objectivity, reliability, and validity in many preliminary studies (cf. Memmert & Roth, 2003). For example, the consistency coefficient in GTS1 and GTS2 is 0.71 and 0.72 respectively. These were similar to other measurements of creativity (see Hocevar & Bachelor, 1989).

The children's performances in the game test situations were recorded on videotape and judged using a subsequent ''concept-oriented expert rating''. The experts were given exact observation criteria. The main evaluation criteria concerned the unusualness of the children's ideas (= originality) and the number of solutions they came up with (= flexibility; see Appendix, first and second columns in both tables). The experts were trained using special videotapes and they underwent a final video-based test to check their expert quality. Only experts showing a high reliability as measured against a ''gold standard'' of ball games experts were chosen. The children in game test situations were evaluated by three ball games experts. Because of the player rotations, each child received two creative values from each of the three coders. Thirty-nine percent of the inter-rater reliabilities (intra-class correlation coefficients) determined for rotations 1 and 2 were very high (>0.95) and 33% were high (>0.90). The remaining 28% were above the crucial limit of 0.80. At the end, all data were averaged into one value for handball, one value for soccer, and one value for field hockey, each covering the three coders, the two

rotations, and the two game test situations (off-the-ball movements and identification of gaps).

Procedure

The children were tested before training (first test) and after 6 months (second test) and 15 months (third test) of training. An alpha level of 0.05 was preselected for all statistical comparisons and effect sizes were calculated.

To investigate treatment-related effects, the development of creativity for each group was examined using separate simple one-way analyses of variance for repeated measures (first, second, and third tests). Different dependent variables were used. The improvement of general creativity (mean value of all three game-oriented measurements) was analysed in the non-specific groups, and the development of game-oriented creativity in the specific groups. For the handball group, for example, only the results from the handball-oriented creativity were evaluated. Thus only the performance of the children in the game test situation in which they were playing with their hands was considered.

For the investigation of transfer-related effects, separate analyses of variance with repeated measures for game-oriented creative performance (handball, soccer, field hockey) were used together with additional correlation statistics. For group-related effects, one-way analyses of covariance with baseline achievement as the covariate and treatment modality as the grouping factor (degrees of freedom = 5) were chosen. The analyses compared the creative performance of participants in the non-specific handball, soccer, and field hockey groups against those in the specific handball, soccer, and field hockey groups respectively. Furthermore, general and game-oriented creativities were the subject of a 2 (group) × 2 (time) analysis of variance with repeated measures on the last factor to determine group differences (non-specific vs. specific) in percentage improvements of creative performance from the first to the second and from the second to the third test.

Results

Treatment-related effects

An initial evaluation stage examined the extent to which the general creativity of the non-specific groups and the particular games-oriented creative performances of the specific groups improved. The results confirm the assumption that the programmes result in the expected treatment-related effects. Whereas there were no improvements in general creativity ($F_{2,18} = 0.673$, $P = 0.52$) or the three game-oriented creativity values (handball: $F_{2,18} = 0.502$, $P = 0.61$; soccer: $F_{2,18} = 0.418$, $P = 0.67$; hockey: $F_{2,17} = 2.793$, $P = 0.09$) for the control group, nearly

Table I. Improvement (differences between the first and third tests) in the mean general and game-oriented creativities for the six training groups together with the *P*-values and effect sizes.

Group	*n*	General creativity Mean	Handball-oriented creativity Mean	Soccer-oriented creativity Mean	Field hockey-oriented creativity Mean
Non-specific handball	12	0.60 $P = 0.065$ $\eta^2 = 0.42$	0.65 $P = 0.193$ $\eta^2 = 0.28$	0.65 $P = 0.242$ $\eta^2 = 0.25$	0.51 $P = 0.118$ $\eta^2 = 0.35$
Non-specific soccer	17	0.15 $P = 0.867$ $\eta^2 = 0.02$	0.04 $P = 0.752$ $\eta^2 = 0.04$	0.18 $P = 0.568$ $\eta^2 = 0.08$	0.48 $P = 0.476$ $\eta^2 = 0.09$
Non-specific field hockey	14	0.56 $P = 0.079$ $\eta^2 = 0.34$	0.67 $P = 0.078$ $\eta^2 = 0.35$	0.59 $P = 0.074$ $\eta^2 = 0.38$	0.49 $P = 0.169$ $\eta^2 = 0.26$
Specific handball	21	0.048 $P = 0.137$ $\eta^2 = 0.26$	1.21 $P = 0.004$ $\eta^2 = 0.60$	0.27 $P = 0.145$ $\eta^2 = 0.26$	−0.05 $P = 0.085$ $\eta^2 = 0.34$
Specific soccer	32	1.16 $P = 0.001$ $\eta^2 = 0.66$	1.44 $P = 0.001$ $\eta^2 = 0.43$	1.14 $P = 0.001$ $\eta^2 = 0.56$	0.87 $P = 0.001$ $\eta^2 = 0.45$
Specific field hockey	23	0.68 $P = 0.001$ $\eta^2 = 0.61$	0.55 $P = 0.024$ $\eta^2 = 0.37$	0.42 $P = 0.212$ $\eta^2 = 0.17$	1.14 $P = 0.001$ $\eta^2 = 0.62$

Note: The improvement coefficients for the mean general and game-oriented creativities cover the results of the three coders, the two rotations, and the two game test situations (off-the-ball movements and identification of gaps).

all experimental groups showed improvements in performance. The three non-specific groups improved in general creativity ($F_{2,48} = 7.945$, $P < 0.01$, partial $\eta^2 = 0.25$), the soccer group improved in soccer-oriented creativity ($F_{2,29} = 27.516$, $P < 0.001$, partial $\eta^2 = 0.66$), and the field hockey group improved in hockey-oriented creativity ($F_{2,17} = 13.267$, $P < 0.001$, partial $\eta^2 = 0.61$). Only the children in the handball-specific treatment did not show an improvement ($F_{2,13} = 2.324$, $P = 0.14$).

Transfer-related effects

To determine whether non-specific treatments also improve game-oriented creative performances and whether specific treatments lead to an improvement in game-oriented creativities of the other two ball games, the non-specific groups (non-specific handball, non-specific soccer, non-specific field hockey) were analysed separately. The control group was not important for transfer-related effects and was therefore not considered. Table I provides a summary of the improvements (differences between the first and the third test) in the three non-specific and the three specific groups.

At first glance, the results showed that the soccer-specific group improved in handball- and hockey-oriented creativity and that the hockey-specific group also achieved better performances in handball-oriented creativity. Upward trends ($P < 0.10$) were also observed in the non-specific hockey (handball- and soccer-oriented creativity) and the specific handball groups (hockey-oriented creativity). What is striking overall is that all differences between the pre- and post-test shown in the upper rows of the cells in Table I are positive. A line-by-line comparison of the improvements in the game-oriented creativity characteristic values confirmed the impression of broad transfer effects. The analyses of vatiance with repeated measures for game-oriented creative performances (handball, soccer, hockey) indicated no differences between the improvements in the three characteristic values for creativity in the non-specific groups (non-specific handball: $F_{2,10} = 0.032$, $P = 0.97$; non-specific soccer: $F_{2,14} = 0.584$, $P = 0.57$; non-specific hockey: $F_{2,11} = 0.073$, $P = 0.93$) or the soccer group ($F_{2,30} = 1.850$, $P = 0.18$). We assume that these results are based on changes in creativity in the non-specific groups and on improvements in creativity in the soccer group. The handball-specific ($F_{2,19} = 12.921$, $P < 0.001$, partial $\eta^2 = 0.58$) and field hockey-specific groups ($F_{2,21} = 5.869$, $P < 0.01$, partial $\eta^2 = 0.36$) improved their handball- and hockey-oriented creative performance respectively.

Finally, the transfer between the treatments was also confirmed by observations of the correlations between the differences from the first to the third test. These demonstrated relationships ($P < 0.001$) between the improvements in handball- and soccer-oriented creativity ($r = 0.33$; $n = 124$), handball- and hockey-oriented creativity ($r = 0.29$; $n = 127$), and hockey- and soccer-oriented creativity ($r = 0.42$; $n = 124$).

Group-related effects

The group-related effects on the children's creative development are shown in Table I. The results of the analysis of covariance of the general ($F_{5,113} = 2.643$, $P < 0.05$, partial $\eta^2 = 0.03$), handball-oriented ($F_{5,113} = 2.643$, $P < 0.05$, partial $\eta^2 = 0.03$), soccer-oriented ($F_{5,113} = 2.643$, $P < 0.05$, partial $\eta^2 = 0.03$), and field hockey-oriented creativity ($F_{5,113} = 2.643$, $P < 0.05$, partial $\eta^2 = 0.03$) showed a group effect. *Post-hoc* analysis indicated that the soccer-specific group was better than the other five training groups in almost all kinds of creativity. More specifically, the soccer-specific group improved more than the other groups in general and soccer-specific creativity ($P < 0.01$). In terms of handball-specific creativity, the soccer-specific group performed better than the non-specific soccer and field hockey groups as well as the specific field hockey group ($P < 0.01$). Finally, for field hockey-specific creativity, the soccer-specific group improved more than the non-specific soccer and handball-specific groups, and the field hockey-specific group improved more than the handball-specific group ($P < 0.05$). No differences were observed between the soccer-specific and field hockey-specific groups.

The percentage increases in creativity between the first and second and between the second and third tests are noteworthy. Surprisingly, a comparison of general creativity between the non-specific ($n = 50$) and the specific groups ($n = 64$) revealed an interaction of the percentage increases ($F_{1,261} = 9.169$, $P < 0.01$, partial $\eta^2 = 0.03$). In the first 6 months, the children following the three specific training programmes improved their general creativity more (35%) than the children following the non-specific concept (10%). During the second part of the treatment, however, this effect was reversed – the non-specific treatment yielded an increase of 32% and the specific treatment of only 21%.

Similar results were also revealed for two of the three game-oriented creative values. Interactions were observed for the specific and non-specific handball (first treatment phase = 9%, second treatment phase = 42% vs. first treatment phase = 53%, second treatment phase = 13%; $F_{1,24} = 3.492$, $P = 0.07$, partial $\eta^2 = 0.13$) and field hockey groups (first treatment phase = 14%, second treatment phase = 27% vs. first treatment phase = 36%, second treatment phase = 12%; $F_{1,27} = 7.274$, $P < 0.05$,

partial $\eta^2 = 0.21$). Only both soccer treatments showed improvements in soccer-oriented creativity in the second treatment phase ($P < 0.05$).

Discussion

The purpose of this field-based study was to evaluate the development of general and game-oriented creativities for non-specific and specific training concepts in team ball sports. All treatments resulted in upward trends in the characteristic values for creativity. Our analysis of treatment-related effects showed that the areas in which the groups were trained were precisely the areas in which they showed improvements. This is not surprising and could be interpreted as a demonstration of the principle of specific training effects.

However, this interpretation has to be quailified by evidence of clear transfer effects of tactical creativity in team ball sports. This result supports previous research in the area of net games. Jones and Farrow (1999) and Mitchell and Oslin (1999) showed that transfer of learning from one net game to another within the same tactical category is possible. One possible explanation for the transfer effects comes from the central assumption on which the *Ballschule* (Heidelberg Ball School) concept is based. According to this assumption, identical, or at least similar, tactical tasks occur to some extent in the different sports games, thus requiring identical or similar solution competencies. In 1960, Wittgenstein described games as members of a family characterized by many common features. In accordance with the theory of transfer and similarity (cf. Schmidt, 1991), it should therefore be possible to transfer improvements in identical tactical strategies, rules or concepts, such as the ability to creatively produce majority situations in soccer, to all other invasion games.

It could even be argued from the results of the transfer-related effects that it makes little sense to talk of game-oriented creativities. Unlike motor competencies, it is possible to train tactical creativity independently of the movement techniques. Whether the data generated in this study support a transfer between different specific creativities or the idea of a general creativity independent of specific ball games remains open. This will need to be clarified in appropriately designed follow-up studies. The question of the generality of the creativity construct is one of the most intensively discussed topics in this field of research (see Sternberg, 1999).

The comparisons of the group-related effects showed that the handball- and soccer-specific groups are in a special position. The small sample size could be the reason why the handball-specific group did not improve much. However, it is also important to note that the results fell only marginally short of statistical significance. A selection effect, which always needs to be taken into consideration in field studies, could have played a role in the good performance of the soccer-specific group, in comparison with the non-specific groups. In Europe, football is by far the most common sport first participated in, especially among boys. Good adult footballers, who often have talented children, tend to send their offspring to soccer-specific training at an early age. Previous experience has indicated that it is difficult to find and convince talented children (or rather the parents of talented children) to take part in non-specific training.

In conclusion, however, the data tend to support the view that non-specific and specific concepts are similar in terms of creativity development. As the comparisons of the percentage increases of the treatment phases have shown, the non-specific approaches can be even more useful in the long term. A quasi-experimental study by Raab, Hamsen, Roth, and Greco (2001) indicated that Brazilian children – with broad and unguided stimuli and game experiences – showed greater improvements in creativity than German children who had received game-specific training and high-grade instruction in sports clubs.

Irrespective of the considerations regarding effectiveness, a series of other arguments speak in favour of applying a non-specific concept for teaching games in schools and during free time. First, the aim of physical education is not to make children specialists in one field of sports. Physical education should be designed to provide many stimuli for taking part in sports outside school and after school hours. For example, not only are jumping and throwing disciplines taught in athletics, instead the children are prepared for all areas of athletics. This is similar to gymnastics training and the same philosophy could also apply to other sports. Furthermore, teaching basic tactical, coordinative, and technical competencies saves time during lessons. These competencies later form a helpful foundation for specific entry into individual sports games (cf. Baker, 2003; Baker *et al.*, 2003; Côté *et al.*, 2003; Wiersma, 2000).

> In our experience the best novice soccer players are those with experience of field hockey, ice hockey, basketball or other team ball sports, because these players already understand the spatial aspects of soccer. Tactically these games are similar even though the skills used are completely different.
>
> (Griffin *et al.*, 1997, p. 9)

Second, from a sport pedagogical point of view, the non-specific approach corresponds to the principles of suitability for age and development. It could be argued that children are not specialists but all-around

players. They want to and should be trained generally in a wide range of disciplines at the start of their sports career. In this way, many children have the possibility of trying several sports games, which helps them to find and choose ''their sport'' by themselves or based on the recommendation of their trainers (cf. Roth, 2004).

Third, motivation is an important factor in teaching team ball sports, as other authors have pointed out (e.g. Darling-Hammond & Snyder, 1992; Holt *et al.*, 2002; Rink *et al.*, 1996). Constantly changing materials (e.g. hockey stick, tennis racquet), balls (e.g. softballs, handballs, balloons), and parts of the body used (hand, foot, head or racquet) in lessons, short-term varied experiences will be ensured, which helps to maintain the children's motivation – all with a minimal amount of organizational work in the units.

Fourth, the problem of young athletes dropping out (especially aged 16 and over) that has been witnessed during the last few years can be diminished by a broader training at the beginning of their ''sports games career''. We believe that general training including several types of ball sports, which provides the children with the option of specializing later, avoids the early ''repletion'' of a specific type of sport (for a review, see Baker, 2003).

Fifth, from a sports medical perspective, a non-specific concept is helpful in avoiding one-sidedness or muscular imbalances during a child's development, and it is therefore essential to focus on the body as a whole and on different parts of the body requiring training. Children should use both hands and both legs or feet from the start of their training.

Finally, two limitations of this study need to be noted. The first is that the skill level of the children, which could not be controlled completely. Although skill level was not the object of testing creativity, one has to bear in mind that tactical decisions are influenced by the possibility of using various kinds of skill execution. Also, instructors with different knowledge and teaching qualities were involved. This problem could not be outcome based solely the fact that all trainers had special licences and were experts in their field of sports games. In future research, we need to evaluate whether the results of the present field-based study can be reproduced in controlled experimental settings with randomized groups and more standardized treatments.

References

Baker, J. (2003). Early specialization in youth sport: A requirement for adult expertise? *High Ability Studies*, *14*, 85–92.

Baker, J., Cote, J., & Abernethy, B. (2003). Sport specific training, deliberate practice and the development of expertise in team ball sports. *Journal of Applied Sport Psychology*, *15*, 12–25.

Bakker, F. C., Whiting, H. T. A., & Van der Burg, H. (1990). *Sport psychology. Concepts and applications.* New York: Wiley.

Côté, J., Baker, J., & Abernethy, B. (2003). From play to practice: A developmental framework for the acquisition of expertise in team sports. In J. L. Starkes & K. A. Ericsson (Eds.), *Recent advances in research on sport expertise* (pp. 89–110). Champaign, IL: Human Kinetics.

Côté, J., & Hay, J. (2002). Children's involvement in sport: A developmental perspective. In J. M. Silva & D. Stevens (Eds.), *Psychological foundations of sport* (pp. 484–502). Boston, MA: Merrill.

Darling-Hammond, L., & Snyder, J. (1992). Curriculum studies and the tradition of inquiry: The scientific tradition. In P. Jackson (Ed.), *Handbook of research and curriculum* (pp. 41–73). New York: Macmillan.

French, K. E., & Thomas, J. R. (1987). The relation of knowledge development to children's basketball performance. *Journal of Sport Psychology*, *9*, 15–32.

French, K. E., Werner, P. H., Rink, J. E., Taylor, K., & Hussey, K. (1996). The effects of a 3-week unit of tactical, skill or combined tactical and skill instruction on badminton performance of ninth-grade students. *Journal of Teaching in Physical Education*, *15*, 418–438.

Gabriel, T., & Maxwell, T. (1995). Direct versus indirect methods of squash instruction. *Research Quarterly for Exercise and Sport*, *66*, A63.

Griffin, L. A., Mitchell, S. A., & Oslin, J. L. (1997). *Teaching sport concepts and skills: A tactical games approach.* Champaign, IL: Human Kinetics.

Guilford, J. P. (1967). *The nature of human intelligence.* New York: McGraw-Hill.

Hocevar, D., & Bachelor, P. A. (1989). Taxonomy and critique of measurements used in the study of creativity. In J. Glover, R. R. Rowing, & L. R. Reynold (Eds.), *Handbook of creativity* (pp. 53–75). New York: Willey.

Holt, N. L., Strean, W. B., & Bengoechea, E. G. (2002). Expanding the teaching games for understanding model: New avenues for future research and practice. *Journal of Teaching in Physical Education*, *21*, 162–176.

Jones, C., & Farrow, D. (1999). The transfer of strategic knowledge: A test of the games classification curriculum model. *The Bulletin of Physical Education*, *25*(2), 103–124.

Kröger, C. & Roth, K. (2005). Ballschule – Ein ABC für Spielanfänger [Ball School – An introduction to game play]. Schorndorf. Hofmann.

Lawton, J. (1989). Comparison of two teaching methods in games. *The Bulletin of Physical Education*, *25*(1), 35–38.

Memmert, D., & Roth, K. (2003). Individualtaktische Leistungsdiagnostik im Sportspiel [Diagnostics of individual tactical performance in sports games]. *Spektrum der Sportwissenschaft* [Spectrum of Sport Science], *15*, 44–70.

Memmert, D. (2006). Developing creative thinking in a gifted sport enrichment program and the crucial role of attention processes. *High Ability Studies*, *17*, 101–115.

Milgram, R. M. (1990). Creativity: An idea whose time has come and gone. In M. A. Runco & R. S. Albert (Eds.), *Theory of creativity* (pp. 215–233). Newbury Park, CA: Sage.

Mitchell, S. A., Griffin, L. & Oslin, J. L. (1995). An analysis of two instructional approaches to teaching invasion games. *Research Quarterly for Exercise and Sport*, *66* (A–65).

Mitchell, S. A., & Oslin, J. L. (1999). An investigation of tactical transfer in net games. *European Journal of Cognitive Psychology*, *4*, 162–172.

Neisser, U. (1994). Multiple systems: A new approach to cognitive theory. *European Journal of Cognitive Psychology*, *6*, 225–241.

Nevett, M., Rovegno, I., Babiarz, M. & McCaughtry, N. (2001). Changes in basic tactics and motor skills in an invasion-type game after a 12-lesson unit of instruction. *Journal of Teaching in Physical Education*, *20*, 352–369.

Raab, M., Hamsen, G., Roth, K., & Greco, P. (2001). Amount of incidental incubation as a predictor for expert creative performance of Brazilian and German national team soccer players. In A. Papaioanua, M. Goudas, & Y. Theodrakis (Eds.), *ISSP World Congress of Sport Psychology 2001* (pp. 292–294). Thessaloniki, Greece: Christadoulidi.

Rink, J. E. (1996). Tactical and skill approaches to teaching sport and games: Introduction. *Journal of Teaching in Physical Education*, *4*, 397–398.

Rink, J. E., French, K. E., & Graham, K. C. (1996). Implications for practice and research: *Journal of Teaching in Physical Education*, *5*, 490–502.

Roth, K. (2004). Ballschool Heidelberg. A new answer to traditional questions (available at: http://www.ballschule.de/publications/paper.html).

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*, 68–78.

Schmidt, R. A. (1991). *Motor learning and performance: From principles to practice.* Champaign, IL: Human Kinetics.

Sternberg, R. J. (Ed.) (1999). *Handbook of creativity*. Cambridge: Cambridge University Press.

Sternberg, R. J., & Lubart, T. I. (1995). *Defying the crowd.* New York: Free Press.

Turner, A. P., & Martinek, T. J. (1992) A comparative analysis of two models for teaching games. *International Journal of Physical Education*, *29*, 15–31.

Vallerand, R. J. (2001). A hierarchical model of intrinsic and extrinsic motivation in sport and exercise. In D. G. Roberts (Ed.), *Advances in motivation in sport and exercise* (pp. 263–319). Champaign, IL: Human Kinetics.

Wiersma, L. D. (2000). Risks and benefits of youth sport specialization: Perspectives and recommendations. *Pediatric Exercise Science*, *12*, 13–22.

Wittgenstein, L. (1960). *Philosophische Untersuchungen (Philosophical studies)*. Frankfurt: Akademie.

Appendix

Scaling for the evaluation of tactical creativity in GTS1: Off-the-ball-movements (orienting and supporting).

Originality of solutions to the situation (using gaps or passing)	Flexibility of the solutions to the situation (using gaps or passing)	Scaling	Anchor examples
Way above average (very unusual)	Two or more (different, original actions)	10	The child demonstrated different, highly unusual solutions to the situations. The optimal positions found in the given time were absolutely unique
Way above average (unusual)	Two or more (different, original actions)	9	The child demonstrated different, unusual solutions to the situations. The optimal positions found in the given time were absolutely unique
Above average (rare)	Two (different, original/rare actions)	8	The child demonstrated different, still unusual solutions to the situations. The optimal positions found in the given time were very rare
Average (rather rare)	Two (different, rare actions)	7	The child demonstrated two different solutions to the situations that were not unusual, but still rather rare. The optimal positions found in the given time were very surprising
Average (quite rare)	Two (different, rare/new actions)	6	The child demonstrated two different solutions to the situations, which were not unusual, but quite rare. The optimal positions found in the given time were surprising
Just below average (still new)	One (rare action)	5	The child demonstrated one solution to the situations that was not the usual standard, but which had already occurred. The optimal positions found in the given time were still innovative
Just below average (very little new)	One (new action)	4	The child demonstrated one solution to the situations that was not the usual standard, but which had already occurred often. The optimal positions found in the given time were still innovative
Below average (rather standard)	none	3	The child generally offered standard solutions to the situations, which had been displayed often. The optimal positions found in the given time rarely showed any innovation
Way below average (almost all standard)	none	2	The child almost exclusively offered standard solutions to the situations, which had all been displayed previously. The optimal positions found in the given time very rarely showed any innovation
Way below average (only standard)	none	1	The child only offered standard solutions only to the situations. The optimal positions found in the given time were never new

Scaling for the evaluation of tactical creativity in GTS2: Identification of gaps.

Originality of solutions to the situation (using gaps or passing)	Flexibility in the solutions to the situation (using gaps or passing)	Scaling	Anchor examples
Way above average (very unusual)	Two or more (different, original actions)	10	The child demonstrated different, highly unusual solutions to the situations. The gaps and passes found were absolutely unique
Way above average (unusual)	Two or more (different, original actions)	9	The child demonstrated different, unusual solutions to the situations. The finding of gaps or playing of passes was unique
Above average (rare)	Two (different, original/ rare actions)	8	The child demonstrated different, still unusual solutions to the situations. The gaps and passes found were very rare
Average (rather rare)	Two (different, rare actions)	7	The child demonstrated two different solutions to the situations that were not unusual, but still very rare. The gaps and passes found were very surprising
Average (quite rare)	Two (different, rare/ new actions)	6	The child demonstrated two different solutions to the situations, which were not unusual, but rare. The gaps and passes found were surprising
Just below average (still new)	One (rare action)	5	The child demonstrated one solution to the situations that was not the usual standard, but which had already occurred. The gaps and passes found were still innovative
Just below average (very little new)	One (new action)	4	The child demonstrated one solution to the situations that was not the usual standard, but which had already occurred often. The gaps and passes found were still innovative
Below average (rather standard)	none	3	The child generally offered standard solutions to the situations that had been displayed often. The gaps and passes found were rarely innovative
Way below average (almost all standard)	none	2	The child almost exclusively offered standard solutions to the situations, which had all been displayed previously. The gaps and passes found were very rarely innovative
Way below average (only standard)	none	1	The child only offered standard solutions to the situations. The gaps and passes found were never new