Assessment of game play in basketball.

Isabel Tallir¹, Eliane Musch¹, Matthieu Lenoir¹, Martin Valcke²
¹Ghent University, Department of Movement and Sport Sciences, Belgium
²Ghent University, Department of Education, Belgium
Email : Isabel.Tallir@ugent.be

Abstract

The purpose of this study was to examine the impact of two instructional approaches, the Invasion Games Competence Model (IGCM) and a traditional approach to teaching basketball on children’s acquisition of basketball knowledge (in the form of decision-making ability) and their memory capacity. Primary school children (n = 97) were assigned at random to one of the treatment conditions: traditional method (control group n = 45) and the IGCM (experimental group n = 52). Both groups received a comparable amount of instruction during twelve weeks. All lessons were organised within the normal school settings and during the PE classes. Basketball instruction was led by the researcher to control for differences in teacher expertise.

Decision-making and memory tests were administered five times, at the start, during the instruction weeks, at the end and six weeks after the last session.

The findings reveal no significant differences between the instructional approaches for the memory test and the decision-making test. Still we find an efficiency effect on the decision-making test for the IGCM approach, which can be interpreted that the IGCM is more efficient but not more effective than the traditional method.

Introduction

A review of the recent literature about instructional approaches for games teaching with focus on tactical approaches indicates that numerous research questions remain unanswered (Rink, French and Graham, 1996). A key problem in this kind of studies is the number of variables that play a role in the relationship between instructional approaches and the resulting game performance of children such as the game chosen, the age of participants, the length and nature of the intervention, the impact variables studied, and the measuring instruments (Rink et al, 1996). It is therefore difficult to compare studies and a close analysis of the multivariate nature of the settings is needed to understand and interpret the results of the research (Rink et al, 1996).

Moreover, as Light and Fawns (2003) argue much research has attempted to measure and contrast skill development and understanding within technical and tactical approaches. It has typically involved the assessment of knowledge in the form of that which is articulated as declarative knowledge and that which is expressed in action as procedural knowledge. This research fails to recognize the interdependence of perception, cognition, and skill execution. Brooker, Kirk, and Braiuka (2000)
confirm this in their argument that cognitive function and physical action are intimately interrelated and interdependent.

The general objective of this study is to examine the cognitive learning results of two instruction approaches for the invasion game basketball. A description of both approaches is given in the methods section. These cognitive learning results are studied simultaneously with the actual skill execution and decision making during game play. The latter are not discussed in this article but will be reported later. Several authors (McPherson, 1994; Thomas, French, & Humphries, 1986) have stressed the importance of multiple measures of both cognition and skill execution. Rink et al. (1996) states that the advantages of a multivariate approach help to build up a more complete picture of the instruction impact and help to get a deeper understanding and structural relationships between variables and processes. Light and Fawns (2003) state that skilful performance in games involves total engagement in the game and draws on cognitive, affective, and physical capacities.

Assessing cognitive learning outcomes without actively playing the game is a first step in reaching a broader insight in game performance. But separating cognitive and behavioral components also presents difficulties. Turner & Martinek (1999) note that a correct decision does not necessarily correspond with a correct action – reflecting the difficulty of interpreting cognitive processes apart from behavioral responses (cfr Rink, 2001). A number of authors refer to the interference of weak technical ball control in decision making and game performance. For instance, Turner and Martinek (1992, 1995b) indicate that players need to master control of the object before they can apply tactical knowledge. Also French et al. (1996) take up this position when they state that skills mastery might constrain decision making.

For the present study, we tried to distinguish between cognition and skill execution, by analysing both determining factors of game play separately and in different settings. In this article we report on the study of cognition by applying video-based assessment techniques. The rationale to choose for video-based assessment builds on the critique of Turner & Martinek (1999) who noted that the correct decision does not necessarily correspond with the correct action – reflecting the difficulty of interpreting cognitive activity from behavioral responses (cfr Rink, 2001). Blomqvist (2001) already demonstrated the useful adoption of video-based assessment methods when developing students’ game understanding in badminton.

**Methods**

**Participants**

The 97 participants in this study were 10-11 year old children (55 girls and 42 boys) from four classes of two primary schools from the same region. Classes were randomly assigned to the two treatment groups. Two classes (the control group) (mean age = 124.7, SD= 7.1) were assigned to the traditional teaching condition and two classes (the experimental group) (mean age = 124.9, SD= 8.2) received the experimental treatment, the Invasion Game Competence Model (Musch et al., 2002) as instructional approach (Table 1). Informed consent was obtained from all participants and their parents or guardians.
Table 1 Mean age and standard deviations of the participating classes (in months)

<table>
<thead>
<tr>
<th>Class</th>
<th>Mean age</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1 (Traditional)</td>
<td>127.7</td>
<td>9.9</td>
</tr>
<tr>
<td>Class 2 (Traditional)</td>
<td>127.4</td>
<td>9.0</td>
</tr>
<tr>
<td>Class 3 (IGCM)</td>
<td>122.1</td>
<td>4.7</td>
</tr>
<tr>
<td>Class 4 (IGCM)</td>
<td>122.6</td>
<td>4.2</td>
</tr>
</tbody>
</table>

Instruction approaches

The traditional approach focuses on the acquisition of motor skills required for the 3 on 3 half court basketball game. Skill acquisition was mainly pursued by game isolated drills, which were only integrated in game situations once they were mastered by the pupils. Each lesson consisted of three parts: (1) an introductory activity, (2) practicing one or more skills (technique practice) and (3) a game (not necessarily related to the 3 on 3 game form) to conclude the lesson. The learning objectives of the lessons were primarily related to offensive skills. Skills studied and practiced during the treatment phase were shooting, basic dribbling, passing and catching, holding the ball, one on one, even numbered and majority situations. At the end of the treatment period, different game situations were presented to the pupils during which they were expected to apply these skills in these games (one versus one, three versus one, three versus two).

In the IGCM instructional mode, the focus was on the decision making component of game performance. The game situation was always the starting point for a lesson, and all learning activities were game related. Nevertheless, the correct execution of the motor skills was still clearly stressed. The experimental instruction focused on aspects of the three on three game play (scoring, creating shooting opportunities, set up an attack). The introductory game is always related to the core of the lesson. During each lesson, the teacher monitored tactical problems while the children played a certain game form (eg. three versus two). This implied stopping the game and questioning the children, thereby encouraging them to think about the aim of the game. Only when children were able to understand that they needed new skills in the game situation, dribbling, shooting and passing skills were introduced and practiced.

Intervention

As stated earlier, the study lasted twelve weeks, during which the pupils received twelve lessons of 50 minutes basketball instruction.

Testing procedure

The participants were tested before, during (two times), at the end and six weeks after the treatment period. These five measurement moments consisted of the administration of the memory and decision-making test, next to the administration of the Groups Embedded Figures Test (GEFT, Witkin
et al., 1971) to determine the field dependence/independence of the pupils. On each occasion a video registration was organised of an actual three on three game (half court) and a three on one game (half court) of the pupils in order to assess actual game performance (results not discussed in this article). Psychometric quality of the memory and the decision-making test is valid and reliable. A confirmatory factor analysis shows that there is no significant difference between the theoretical model and the measurement model as reflected in the data. The goodness-of-fit confirms this conclusion: $X^2 = 64.98$, df = 64, p = .44.

Decision-making test
The decision-making test was composed of seven video-based items. Three items focus on offensive on-the-ball decisions, one item centres on an offensive off-the-ball decision, one item centres on defence decisions, and two items centre on the rules of the basketball game and techniques. Three video clips were presented in relation to each item. The pupils had to choose one of the three clips as the right, most optimal or most relevant decision. The three video clips first were presented at the actual speed of the play with a first chance to give an answer. Next, the same video fragments were shown in slow-motion (75% of the actual speed). A weighting scheme, based on experts’ judgments, was used to score the participants’ responses. 10 points (75% = 8 points) were awarded for choosing the best option, 6 points (75% = 4 points) for opting for the second best option, and 3 points (75% = 0 points) when the third option was selected. A total decision-making score was calculated by summing up the seven sub-scores, with maximum of 70 points.

Memory test
The memory test was composed of six items. Each item builds on remembering elements from a video clip of a game situation. The game situation varies from a cutting action of a player or the way a scoring attempt is made to which player takes the rebound. The pupils first watch a video clip of a particular game situation, followed by three short fragments. Only one of these originates from the original video clip. After seeing the video clip at normal speed of play, pupils respond. Next the fragments are shown again in slow motion (75% of the actual speed of play). Again a weighting scheme, based on experts’ judgments, was used to score the participants’ responses. 10 points (75% = 8 points) were awarded for choosing the right fragment, 0 points for the wrong answer. The maximum score for the knowledge test score is thus 60 points.

Results
In the statistical tests, group (traditional method, IGCM) is the between subjects variable, decision-making test and memory test are the two dependent variables.

Decision-making test (fig 1)
Analysis of variance with Repeated Measures (General Linear Model) reveals a significant main effect for time $F_4 = 10.55$ ($p < .001$) which indicated that each group improved in time. There is no significant interaction effect between time and group $F_4 = 1.79$ ($p = .130$). There was no significant main effect of group $F_1 = 2.13$ ($p = .148$).

Figure 1 – Total score on the decision-making test for the traditional method group and the IGCM group.

Memory test (fig 2)

Analysis with Repeated Measures of Anova indicated that there was a significant main effect for time $F_4 = 19.41$ ($p = .001$). There was a significant interaction effect between time and group $F_4 = 2.93$ ($p = .021$). There was no significant main effect of group $F_1 = .433$ ($p = .513$). Both groups improve over time. Analysis of figure 2 shows that the learning impact over time is different for the experimental and control group.
Further analyses with an independent samples T-test showed that the IGCM group score significantly higher on the pretest $t(2,044) = .044$ and on posttest $t(2,088) = .040$. Table 2 provides a summary of the means and standard deviations for the memory tests.

**Table 2** Total test scores and standard deviations for the memory test.

<table>
<thead>
<tr>
<th></th>
<th>Traditional method</th>
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<th>IGCM</th>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Pretest</td>
<td>41.3</td>
<td>14.9</td>
<td>46.0</td>
<td>13.6</td>
</tr>
<tr>
<td>Intermediate 1</td>
<td>51.9</td>
<td>7.7</td>
<td>48.4</td>
<td>9.1</td>
</tr>
<tr>
<td>Intermediate 2</td>
<td>52.7</td>
<td>10.7</td>
<td>52.1</td>
<td>8.1</td>
</tr>
<tr>
<td>Posttest</td>
<td>51.3</td>
<td>10.3</td>
<td>54.2</td>
<td>7.8</td>
</tr>
<tr>
<td>Retentiontest</td>
<td>52.9</td>
<td>9.7</td>
<td>54.4</td>
<td>9.0</td>
</tr>
</tbody>
</table>

**Discussion and conclusion**

In line with Thomas & Thomas (1994), we distinguished in this study between the quality of decision-making in a game situation and the actual execution of motor skills during game performance, although both determine successful game performance. French & Thomas (1987) note the mistake frequently observed in young children in various sports may stem from a lack of knowledge about what to do in the context of a given sport situation.

In this study a multiple measurement procedure was adopted to study both the impact of instructional approaches at cognitive and skill performance level. The measurement procedure was built on both game and non-game situations. As stated earlier this approach was adopted to deal with the problem
that often children know what to do, but are not able to do it in a game situation, due to an insufficient skill level (Blomqvist, 2001).

The results of the study indicate that there is no differential impact of the two instructional approaches on the decision-making or memory test. Both conditions show a comparable growth in decision-making and memory scores. But it is interesting to study how the nature of the growth in test scores is gained. In relation to the decision-making test, pupils in the traditional instructional condition reflect a linear improvement in test scores, whereas the pupils in the IGCM condition mirror a major and significant increase in test performance on intermediate test 1. These significant differences disappear when we take the following test scores into account. We can conclude that the IGCM approach results in an increase in efficiency of the learning process, i.e. the time needed to reach a certain impact level. The more efficient acquisition of decision-making knowledge in the experimental condition can be explained by the complex nature of the learning context. Right from the start, pupils have to cope with this type of situations.

Concerning the memory test, we observe a totally different pattern in the increase of test scores. The scores of the pupils in the traditional instruction condition reflect a significantly higher increase on intermediate test 1. However, the increase in relation to the following test administrations is no longer significantly different. On this memory test, the pupils in the IGCM condition echo a linear and gradual improvement in test scores. Based upon the results of the memory test, we might conclude that the traditional instructional approach is more efficient in reaching higher memory scores at an earlier stage. The better retention scores of the pupils in the traditional condition can be explained by the focused nature of the teaching strategy. Instead of complex learning settings, touching on a variety of topics, a more limited set of knowledge elements is dealt with.

An additional comment is needed when discussing the absolute differences in final scores. For the decision-making test we find an average increase of 7 points between the first and fifth test administration. For the memory test this overall increase is 13 points. We might consider this increase in test scores as low. Possible explanations might be the specific format of the video based test, the difficulty level of the test or the small number of videofragments used. Light and Fawns (2003) call for assessment instruments that strive to assess knowledge as performance in games rather than knowledge of performance which will provide more authentic means of assessment. Therefore additional research is needed to optimize the tests in view of this kind of variables and processes. Furthermore, the structural relationship between the decision-making and memory test and the actual game is also to be studied. This will be the focus of the next report in relation to this study, when the test scores will be linked to other individual characteristics (e.g., perceptual preferences) and the quality of the actual games played by pupils in both conditions.

As stated before, additional analyses will be needed to come to more definite conclusions about the differential impact of the two instructional approaches. Of crucial importance will be the multi-variate analysis of all measurements gathered during the study. At a first level, structural equation modelling
(SEM) will be used to study the complex co-variance structure between game performance, decision-making knowledge, memory, cognitive style (field dependence / independence), gender and instructional format. Next, the multi-level structure of the impact will be studied to analyse whether differences at individual level, group level, class and school level play a role in the interaction between independent and dependent variables.
References


