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Effectiveness of a video training programme used to improve error identification and feedback processes by physical education student teachers

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1. Introduction

Many teachers are deeply convinced that feedback is a teaching function of prominent importance helping pupils learning motor skills. Moreover, it was identified as an indicator of teachers' enthusiasm (Caruso, 1980; Cloes & Piéron, 1989; Rolider, 1979). Several teaching effectiveness studies have evidenced that feedback was positively related to pupils outcomes or that it made the difference between more and less effective teachers (Phillips & Carlisle, 1983; Piéron, 1983). It is also one among the characteristics of teaching behaviours emitted by experts when they are compared to novice teachers (Piéron, 1982).

It is not surprising that teacher feedback was selected as target behaviour in teacher training programmes, and more specifically when the multiple baseline behaviour modification technique was used. To date, most of these programmes have been successful at raising the intervention rate, at balancing positive and negative feedback and, at improving the ratio of specific feedback intervention (Cloes & Piéron, 1991; Hughley, 1973). All feedback modification projects led to intended changes as far as subjects agreed with the experimental objectives. Supervisor, cooperating teacher, peers or subjects themselves have been the active agents of the modification intervention (Piéron, 1993; Siedentop, 1981).

It was observed that the quality of feedback was another determinant of learner's achievement (Carreiro da Costa & Piéron, 1992). However, very few studies have been devoted to investigating the most appropriate means to improve the quality of feedback. The quality of feedback is often related to its appropriateness. It concerns essentially the consistency between the content of the message and the learner's performance. This aspect is pretty complex and depends directly on the mechanisms related to feedback emission.

Several authors have proposed models of feedback emission (Armstrong & Imwold, 1982; Cloes, Hilbert & Piéron, 1995; Hoffman, 1983). These converge to two interactive processes: (1) the diagnosis

or task analysis aiming to identify correct and incorrect aspects of the pupils' performance; and (2) the prescription corresponding to the selection and emission of a message.
From the learner's viewpoint, several questions have been raised concerning feedback appropriateness: Is the learner able to understand the message? Is the learner able to implement the proposed changes? Is the character of feedback compatible with the pupils' affectivity?
All these aspects of feedback appropriateness are closely related and quite hard to isolate. To this point of the research, we shall consider only the aspect linked to the content of the message.
Developing a competency in task analysis should be hypothesized as a first order means to improve the quality of feedback. Authors have completed studies focused on various aspects of the task analysis (Armstrong, 1986; Sipp, 1984; Harari & Siedentop, 1990; Franks, 1993).
Some improvement in the task analysis process resulted from video training programmes (Bell, 1987; Eckrich, 1993; Morton, 1990). However, we still lack the information on possible improvement of the quality of feedback based on specific preparation in task analysis.
A few years ago, we began a research programme emphasizing the relationship between the error identification process and the delivery of the feedback message (Cloes, Hilbert & Piéron, 1995). The first step was to compare the effects of three different teacher training approaches on variables such as specific knowledge, quality of error identification and characteristics of feedback. These approaches were: (1) field experience, (2) field experience and analysis of various specific movements, and (3) field experience, analysis of movements and error identification training on video-tapes.
Results showed that video training aimed at error identification led to substantial improvement in quantitative and qualitative aspects of the sport skill analysis process. No significant influence was observed on the characteristics of the feedback message in a microteaching situation (eight minute lessons given to physical education students).
From the findings of the initial study, it was hypothesized that feedback resulted from a holistic process involving diagnosis and communication skills. Teachers should be trained specifically to use their diagnosis skills as a basis to select the most appropriate message.
The actual study arose from this hypothesis. It was the second step of our research programme in which we developed a video programme including error identification and feedback emission training and in which we assessed its effectiveness.

2. Method

2.1 Design of the study

The design of the study was a comparison between control and treatment groups. Pre- and post-tests focused on:

(1) the knowledge of the critical elements related to six target technical skills selected in volleyball. That assessment was based on a questionnaire comprising open and closed questions;
(2) the ability to identify errors from 30 video-taped movements by using a check-list;
(3) the characteristics of feedback issued in a simulated teaching situation (i.e. the video- taped sequence proposed for error identification).

In a simulated teaching situation, the teacher:

(1) observes a video-tape showing motor performances;
(2) analyses the tasks and, eventually;
(3) identifies errors before reacting in delivering a message as if he/she was talking to a pupil. That procedure was seen as an effective tool to analyse the variability of teacher feedback (Cloes, Deneve, & Piéron, 1995).

Eighteen physical education student-teachers were distributed in an experimental group of 10 (7 boys, 3 girls) and in a control group of eight (6 boys, 2 girls). Analysed through the Mann-Whitney U Test, pretest performances of both groups did not differ significantly.

The treatment proposed to subjects from the experimental group was a video training programme distributed in two sessions of ninety minutes. It focused on the main technical volleyball skills. The video-tape presented at first informs about the skills: listing of the critical elements, analysis of the correct movement, and presentation of typical errors. The second step dealt with the training in error identification and feedback emission. In the control group, subjects did not follow any specific preparation.

2.2 Data processing

Data were processed by a biostatistics software programme. Statistical tests were chosen among Mann Whitney U Test, Student t test and Wilcoxon signed rank test (Glantz, 1988). The reliability of the feedback analysis was determined by calculating interobserver agreement for the analysis of a sample of 166 feedback statements. Percentages of agreement ranged from 81.1 % (appropriateness of the feedback) to 89.9% (referent identification).

3. Results

The text will be focused successively on the following aspects:
- the content knowledge;
- the error identification or diagnosis;
- the feedback or message characteristics;
- the overall changes.

3.1 Changes in the specific knowledge

Although both groups were similar at the pretest, the subjects from the experimental group achieved a significantly better performance at the post-test ($t = 2.049$; $p = .05$) (table 1). Improvement of that group (+7.0/100 points) was statistically significant ($W = -41$; $p < .05$) while the changes observed by the subjects from the control group (+5.1/100 points) did not reach significance ($W = -18$; $p > .05$).

Table 1: Comparison of the results of control and experimental groups (* for $p < .05$)

	Pretests		Post-tests		Improvement	
	Control	Experimental	Control	Experimental	Control	Experimental
Scores of specific knowledge (/100)	57.6	64.8	62.7	71.8*	+5.1	+7.0
Scores in error identification (/100)	48.5	48.2	41.8	52.5*	-6.7	+4.3*
Amount of feedback	71	53	69	65	-2	+12
Scores of appropriateness of feedback (index/4)	1.98	2.16	2.04	2.27	+0.06	+0.23

Rehearsing the critical elements of the skill during the training programme and analysing the movements seemed to improve the specific knowledge. It could be considered as a factor contributing to the quality of the error identification process (Cloes, Hilbert, & Piéron, 1995).

3.2 Changes in the error identification score

Findings were as follows:

(1) At the post-test, subjects from the experimental group achieved significantly better than those from the control group ($t = 2.133$; $p = .03$) (table 1);

(2) Absolute gains of the subjects from the experimental group were higher than those of the control group subjects: +4.3 vs - 6.7 points/100 ($t = 2.223$; $p = .03$) (table 1);
(3) Relative gains were also in favour of the subjects from the experimental group: + 8.4 vs - 13 per cent gain of possible gain ($t = 2.133$; $p = .03$);
(4) the changes of the scores of both groups was not statistically significant. However, eight out of 10 subjects in the experimental group achieved higher scores after their video training.

These results support the effectiveness of the video programme and confirm the trainability of the task analysis process through video (Bell, 1987; Morton, 1986).

Concerning the transfer of that improvement to live setting, a recent study points out that more research are necessary (Eckrich, Widule, Shrader & Maver, 1994).

3.3 Changes in characteristics of feedback

Two characteristics of the feedback will be analysed: (1) the quantitative aspect (feedback rate), and (2) the qualitative aspect (appropriateness). Due to technical problems, data of the feedback analysis were not directly available for two out of 10 subjects from the experimental group.

3.3.1 Changes in the amount of feedback

The amount of feedback emitted in reaction to the 30 movements shown on the video-tape increased in the experimental group while a slight decrease was observed in the control group (table 1). Changes of both groups were not statistically significant ($W > -5$; $p > .05$). This should be related to the wide range of the changes' variability: -23 to +38 in the experimental group Vs -29 to +25 in the control group. That variability is extremely difficult to explain.

Nevertheless, when we consider the initial level of the subjects, changes of the feedback's amount presented different tendencies in each group. In the control group, whatever the initial performance, changes were equally positive or negative. On the opposite, subjects from the experimental group improved their performance when they started from a low initial level and decreased the feedback amount when they started from a high initial level. The correlation was significant ($r = - .902$; $p = .002$). In experimental conditions, higher performers should become more reflective in emitting feedback. They should have been more reluctant to provide wrong information. Furthermore, they used a little more time to formulate their prescription from their diagnosis to be sure of its appropriateness. In the experimental group, initial poor performers gave more feedback. They should have improved their specific framework, accelerating the treatment of the information during the processes related to the feedback emission. However, they should lack enough discernment in their reactions.

The differential effects of the video programme underline the problem of the individual treatment necessary in teacher behaviour modification programmes.

3.3.2 Changes in the appropriateness scores of the feedback

The appropriateness of the feedback was assessed by the degree of consistency between the content of the message and the errors identified by three volleyball experts.

Appropriateness scores increased slightly in both groups (table 1). Changes and differences pointed out from the comparison of experimental and control groups were not statistically significant ($T>60$; $p>.05$). Although the relative gains were higher in the experimental than in the control group (+6.0 Vs +2.7 per cent gain of possible gains), changes observed in feedback quality did not support a strong effect of the video programme on the target behaviour.

Nevertheless, the four subjects from the experimental group who have decreased their amount of feedback improved their appropriateness score. The same finding was not observed in the results of the control group when feedback rate dropped. This supports the explanation given about the changes of the amount of the feedback.

At this level of the analysis, the experimental programme seems to be less successful than initially expected, particularly in the area of feedback characteristics. We suggest that the feedback training should be longer than that used in the experiment. Furthermore, a large interindividual variability was observed in the effects of the programme. It could have influenced the stability and consistency of the results.

3.4 Overall change of each subject

Changes in specific knowledge, in score of error identification and in feedback appropriateness were listed for each subject. Individual changes were compared to the mean changes and rated on a five-levels rating scale. The overall score was assessed using the same process.

Among the 11 subjects showing the more favourable overall changes, eight were observed in the experimental group (table 2). This result should be considered as an indicator of the effectiveness of the video training programme.

Table 2: Overall change of each subject

Subjects of the exper. group	Theoretical knowledge	Error ident. performance	Feedback appropriateness	Overall evolution
1	0	++	/	+
2	-	--	/	--
3	0	0	+	+
4	--	++	++	++
5	0	+	-	0
6	++	-	0	+
7	++	+	--	+
8	+	++	0	++
9	+	+	0	++
10	++	0	0	++
Subjects of the control group				
11	--	0	-	--
12	0	--	0	--
13	--	+	++	+
14	++	--	+	+
15	--	0	+	-
16	0	+	++	++
17	+	0	-	0
18	+	--	--	--

Analysing individual results in the experimental group, subject number 2 differed from the general trend observed in the group. This subject maintained the same score at the specific knowledge test and completely failed at the post-test for error identification. He seemed to be more critical towards the movements shown on the video-tape than during the pre-test but was less accurate in his analysis in his apparent desire to give quick answers. An informal interview of the subject showed that he was afraid and lacked the necessary concentration during the post-test. On the other hand, he told that he was not very happy with the way he managed the video training programme.

In determining the effectiveness of the experimental procedure, such individual poor performances tend to influence considerably the statistical level of the differences observed between groups. It seems that experimental designs utilizing multiple baseline techniques could be more powerful in interpreting data and seeking causal relationships. This could be an interesting way for future research.

4. Conclusions

A video training programme combining a descriptive analysis of the technical skills, a systematic presentation of typical errors, and a preparation focusing on error identification and on feedback emission have contributed to improving the specific knowledge of critical elements of the analysed skills and the quality of the error identification process. Few favourable effects were observed in the

characteristics of the feedback. The duration of the feedback training was yet considered as too short to improve clearly the link between diagnosis and prescription. Moreover, individualization of the treatment related to subjects characteristics and needs was underlined as a promising way of future research. Overall effectiveness of the programme was shown through comparison of individual changes in each variable allowing us to consider that the study concerning the use of the experimental programme should be envisaged.

However, we are well aware that the study of transfer from laboratory conditions to live settings should be set up before proposing a systematic use of the procedure in teacher training. This could be a priority for future researches on that topic.

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