International Journal of Physiology, Sports and Physical Education
Online ISSN: 2664-7729; Print ISSN: 2664-7710
Received: 01-11-2018; Accepted: 03-12-2018; Published: 03-01-2019
www.physicaleducationjournal.net
Volume 1; Issue 1; 2019; Page No. 01-08

Influence of school level and learning of front rolling on the imagined representation of Congolese students

Mabassa David Sylvain[1]*, TIRA Juslain Joel[2], Ambeto Aime Simplice Christophe[3], Koulombo Armel[4], Mabassa Ngongo Valda Holbrich[5], Mabialas Josiane Marinick Suzie[6], Itoua Okemba Jean[7]

[1-7] Institut Supérieur d'Education Physique et Sportive (ISEPS), Marien NGOUABI University, Brazzaville-Congo

DOI: https://doi.org/10.33545/26647710.2019.v1.i1a.1

Abstract

The aim of the study is to compare the pictorial representation of the movement of a gymnastic element with the execution of this same element. The analysis focuses on the front roll, a complex movement to students. The observation method was chosen, of which the only independent variable is the school age of the students (6-18 years). This cross-sectional observation was made using a multiple experimental device. Two measuring instruments were used together: the ad hoc observation grid built by Physical Education and Sports (PSE) teachers and the iconographic questionnaire completed by each student before and after the execution of the movement, to see if the evolution of the Imaged representation of motion depends on the effect of the school age factor or the effect of repetition of the learning factor or whether it is the result of both. The results show that the front roll recognition test is only effective for high school students (17-18 years old) and the motor performance test, on the other hand, shows an effect of school age on the quality of the execution of the movement for primary school pupils (6-7 years old). Thus, the better the student is able to execute a quality front roll, the better he is able to identify a correct iconographic representation of the roulade.

Keywords: learning, rolling forward, gymnastics, mental representation, age, repetition

Introduction

To learn is to impose oneself on environmental constraints in order to succeed in an action, or in other words, to successfully solve the problems posed by the environment. Learning manifests itself in two ways: - a qualitative and quantitative modification of the conduct in the immediate future. - by innate and acquired conducts.

In the first case, the qualitative and quantitative modification of the conduct, refers to the fact that the subject will transform his modes of action in the face of a situation. In a roll before, the subject will coordinate more and more phases of momentum, impulse, the laying of hands, the ball and rolled (qualitative transfo). Normally this should lead to a quantitative transformation: improving performance or score. This type of transformation refers to the notions of: - performance (quantitative) -competence (qualitative). Both can evolve together but also separately. It refers to what Piaget (1974) calls success and understanding. One can modify a technique (understand) without modifying the performance (succeeding). One can understand a problem and find the solution to the problem without being able to put it in place (to know a regulation and not to apply it). You can do an exercise without understanding why. Success is then different from competence. If there is competence and success, it is because the subject has acquired a behavior, and that the latter is therefore sustainable (objective of the physical and sport education).

In the second case, the innate and acquired behaviors refer to processes related to maturation (development). And there are periods conducive to certain learning, in relation to the development of the child. The phenomena of growth and maturation are related to the fact that the child is born with structures to develop (maturation of the brain that will play a role in the comprehension, especially through the proximal distal space). See the basic skills: locomotion, manipulation and non-locomotion (posture) and their evolution (0/3 years, 3/7 years, 7/11 years and adolescence). In fact, up to 7 years old, we talk about fundamental motor skills and after 7 years of sports motor skills (6/7 years is the "pivotal age" where basic skills are acquired.

In relation to these periods, this means that learning of motor skills should occur after 6/7 years (functional motor skills, which can be coordinated in more complex skills). (Piaget, 1967).

The individual is adapted when he is able to use his acquired motor skills (learning) or innate (maturation and development), to cope with the constraints of the environment. For Piaget (1967), adaptation must be characterized as a balance between the actions of the organism on the environment and the inverse actions. In fact, adaptation refers to the state of equilibrium between the projects that are fixed by man and the fact that they realize them. But, you always need a state of imbalance so that the man adapts and discovers the new properties of the world around him. Learning is a form of adaptation in the sense that the individual will discover new properties of action, except that learning is about the medium term while the latter as development refers to the long term (stabilization acquired skills) and requires skills. Thus, behavior and performance are of the order of immediacy.

However, the theoretical models of psychological development all point to the existence of an order, even a gross one, in the evolution of motor behaviors. The notion of stage, which underlies this order, has evolved since Piaget (1974). It then corresponded to a hierarchical structure or organization in which a new stage did not replace or simply add to the previous one, but integrated it and thus transformed itself into a larger and more complex entity. At present, three theoretical orientations give a different interpretation of the notion of stage (Hauert, 1990).

The effect of school age in motor tasks has been demonstrated by experimental situations such as pointing tasks (Hay, 1979) or visuo-manual pursuit (Mounoud et al., 1985), tasks measuring kinesthetic sensitivity (Laszlo and Baistow, 1985) or more complex tasks, such as walking (Bernstein, 1967). These studies show a qualitative change in pupils' perceptual and motor strategies around the age of 7-8 accompanied by a transient regression of certain aspects of performance.

However, the movement of repetition as a learning factor analyzed in a developmental orientation inevitably entails taking into account the student's learning abilities. Our purpose is to focus on the psychological aspects of motor learning, trying to highlight the process and the resulting performance.

In this regard, Schmidt (1988) reveals that learning is the acquisition of motor skills (theories that focus on the construction of skill). The motor control concerns him, the production of movement, that is to say the way in which the movements necessary to solve an engine problem posed by the environment are produced and corrected. How does the student produce a movement? In general, motor control theories are interested in the motricity of the expert. Currently, two theories oppose this concept of motor control: - cognitive theories for which, cognitive control is provided by cognitive operations, which act on the representations of the individual, and which allow the feeding of a motor program. The idea is that the nervous system is functionally organized and this organization allows the control of movement. - the ecological theories for which the central cognitive treatment is not necessary, and especially not the representations, and according to which the movement emerges directly from the constraints of the environment (the perception is fundamental for motor control). In addition, the concept of a motor program makes it possible to account for the processes that lead to the elaboration of a response. It was developed by Keele (1968), repeated by Adams (1987) and then by Schmidt (1988, 1993).

For Keele (op cit), the motor program is a series of structured muscle commands before the start of a motor sequence that allows the entire sequence to be executed without being influenced by peripheral feedbacks. It would be a predetermined organization of the action. The idea is that there is a predetermined organization of the movement before its production, and the specification of all the parameters (motor units, order, timing).

Indeed, there are two opposing or rather complementary opinions with respect to this notion of motor program: - Central opinion or open loop control: idea that all the commands are predefined. These commands are ordered and allow the achievement of a specific goal. There are no possible feedbacks (no feedback). Each answer corresponds to a motor program (first opinion: centralist). It will therefore relate to very fast movements or discrete skills. - Peripheral or closed-loop opinion: Sensory feedbacks on the movement are taken into account (exteroceptive or proprioceptive) for the regulation of the movement therefore in fact no motor programs. In fact, this model corresponds to the control of long movements (sequential or continuous tasks).

The problematic of this study lies in the theories raised by the models of Keele (op.cit) (no regulation possible during the execution of the movement) and Adams (problem of the storage of the information and the novelty of a movement), Schmidt (op.cit) elaborated the theory of schemas. Now, the schema is the organization common to all the motor acts which possess a certain identity of structure, a global resemblance. The scheme is therefore transferable to any category of similar actions. For Schmidt (op.cit), the schema is the rule linking the different results of the members of an action class to the parameters that determine the result.

Indeed, the schema defines the general characteristics of the movement that must be organized according to the characteristics specific to the environment and the purpose of the subject. The diagram represents the properties of the sequences, the space, the pattern (general shape) of the movement, which are memorized and applicable to a class of specific movements according to a particular goal.

To allow a better understanding of its model, this general motor scheme, Schmidt (op.cit) will call it Generalized Engine Program (GEP), to differentiate it from entities that will find the PMG: recall and recognition scheme. Of these 2 elements, will depend the diagram of the motor response.

How does the theory of schemas solve the problem raised by previous models?

Storage: Adams (op.cit) considered that each gesture corresponded to a motor program stored in the plane of the central nervous system. But how to explain for example, a tennis player catches bullets in any situation, position, etc.? Given the number of possible combinations in speed, angle of attack, overall trajectory of the ball, etc. Each shot can be considered new. This would mean that the tennis player would have an indefinite number of motor programs. Schmidt (op. cit) postulates that these are the schemas he will call generalized motor programs (GMP), which are stored and not the gestures themselves.

-Novelty: How to explain that one sometimes realizes and at the first blow gestures that one had never done before? According to the theory of Adams (op.cit) or Keele (op.cit), one might wonder where this motor program comes from since never realized or repeated before and yet realized without fault. According to Schmidt (op.cit), the motor diagram or GMP would be the basis of construction of the movement and which therefore allows to produce new movement thanks to two entities: the scheme of recall and that of recognition. In addition, the fine and precise analysis of the kinematics of the gesture, shows that there is never identical reproduction of two successive gestures. There is always a certain variability of the gesture, which supposes the existence of invariants of the movement while other parameters can vary.

By definition, the notion of a Generalized Motor Program (GMP), proposed by Schmidt (1988, 1993), accounts for the nature of the abstract representations that give rise to movement. These would be cognitive structures that generate a set of commands that characterize a class of movement.

For Schmidt (1988, 1993), there are things common to the different actions we perform: invariants. It is therefore possible that the nervous system stores the motor programs mentioned by Keele (op.cit), not in their integral form but in the form of invariants: characteristic of a set of movements that remains constant, or invariant, then surface characteristics change (Schmidt, op.cit).

To understand his basic notions, Schmidt (1988) defines learning as a process of acquiring the capacity to produce a powerful action, the author considers it as a stable resultant of practice and experience, the process learning can not be observed directly, behavioral changes being internal and not accessible to direct observation. In this regard, Schmidt (op.cit) proposes four experimental "designs" to measure the learning process:

- Two or more groups of students practice a task at different levels of an independent variable (for example, speed of execution of the movement, size of the target). A common analysis method describes the performance at all trials or the average performance at each trial on a large number of students. This analysis highlights the evolution of the learning process or strategies;
- Other experiences, referred to as "design transfer", subject groups of students to different levels of requirements of the Independent Variable (IV). Their practice is then transferred to a common level of the independent variable. Outcomes are discriminated between long-lasting effects (due to learning) and transient effects (due to performance);
- When the performance thresholds are reached, that is to say that the level of the results does not vary more than a minute, a method of analysis of the secondary tasks can be used. In this case the independent variables are, for example, latency, attention, effort, retention and generalizability measures;
- Finally, a last method, which we applied in our study and which corresponds to the transfer of learning, is characterized by the increase (or the decrease) of the capacity to answer a task, this one being the result of practice or experience of another task.

In our study, we consider the repetition of action as a general factor of learning. The measure (dependent variable) relates to the graphical questionnaire, which is the student's ability to recognize errors and thus to correctly represent the movement. This ability is influenced at a given age by practice. Therefore, we do not measure the transfer from one motor task to another motor task, but the effect of repetition of movement on the student's ability to represent it.

In the same vein, image is, with language, one of the main components of the individual's cognitive system. Denis (1989) defines it as a modality of mental representation whose essential property is to preserve perceptual information in a form that has a high degree of structural isomorphism with perception. One of the functions of the representation systems is that they allow guidance, orientation and regulation of the action. They are progressively refined with age, as several authors have shown (Piaget et al., 1966, Lautrey, 1990). Especially since the front roll is in the category of morphokinesis whose realization depends on an internal model generating a specific motor form (Paillard, 1974, Serre, 1984). Also, the front roll can be considered as linked to the representation of a rotating body before. The interaction between perception and the imaginative processes of a rotating object has been studied in adults and children (Cooper 1976, Corballis and McLaren 1982, Lautrey and Chartier 1987). These studies, which consisted of ask the subject to turn the image of an object "in his head" to compare it to the real object, have demonstrated the effect of several parameters that justify the tests we have built. In particular, the imagined rotation passes through a series of intermediate states that correspond to the successive positions of the object during the physical rotation (Cooper, op.cit).

How will representation guide the formation and coordination of means and procedures?

The experiment is set up in order to deepen the links between action and developmental representation according to two axes:

-effects of school age: these two capacities evolve significantly between 6 and 18 years;

-effects of repetition learning: after performing this movement several times, students improve their cognitive representation.

The representation of the movement is measured by the student's ability to recognize the front roll among other rotational movements and to identify the errors introduced into sequences of drawn shapes.

The quality of the execution of the movement is measured by the number of execution errors. Errors decrease with school age and enforcement procedures change with school age: students do not make the same types of errors and these errors are distributed differently, considering the beginning or the end some movement.

To answer this fundamental question, we formulate the hypothesis that "the better the student is able to execute a quality front roll, the more he is able to identify a correct graphical representation of this roulade.

2. Methodology

2.1. Fields of instigation

This study took place in the different schools of Brazzaville, specifically the Mfoa primary school, the Bernatte BAYONNE: secondary school, and the Chaminade: high school. The choice of schools was made on the basis of a random draw at 1/10. The study ran from October 20, 2018 to April 22, 2019, which is six months of experimentation.

2.2. Participants

The sixty (60) selected students were all male, aged 6 to 18, from primary, high school, high school Brazzaville. All students had an average of three learning sessions per week and had a similar level of intra-class performance in their ability to perform the roll before. The students were divided into three grade levels: the primary grade (average grade 2) (aged 6 - 7 years, N = 20), middle school (grade 3) (aged 14-15, N = 20) and high school (terminal grade) (aged 17-18, N = 20).

2.3. Experimental protocol

Two instruments of observation were used together, in order to identify whether the evolution of the mental representation of the movement depends on the effect of the school age factor or the effect of the repetition of the learning factor or if it is the result of both. The first instrument is an ad hoc observation grid built by Physical and Sport Education' teachers, and they have judged the quality of execution of the movement by annotating the gymnasts' execution errors. The second is an iconographic questionnaire completed by each student before and after the execution of the movement.

- The particular conditions of the observation method are realized when the experimental modalities are identical for all the pupils and only the independent variables invoked are taken into consideration in the observation plan.

In parallel to these two observations, we analyzed the kinematic aspects of the movement such as the duration, the total speed and the angle of opening of the hips during the rotation. This analysis focused on the 20 front rolls. The student had to perform this movement at three different speeds: normal speed (10 rolls), slow speed (5 rolls), fast speed (5 rolls). The two roulades judged by the performance test were the last two of the series run at normal speed. During the kinematic analysis, we have highlighted the role of the dynamic aspects in the organization of this movement and in particular the impact of the body masses during the forward roll, as well as the way in which they combine with the cognitive processes (Manidi, 1990).

2.4. Procedure

The experiment took place in the gymnasium Maxime MATSIMA of Makélékélé, located at the Institut Supérieur d'Education Physique et Sportive (ISEPS). Each student passed successively to three positions:

- post 1: he first filled out a test questionnaire;
- post 2: he then performed 20 roulades. Four experienced teachers of physical and sport education judged, using an observation grid, two of the 20 performed by each student;
- post 3: he answered the same test questionnaire a second time (see item 1), immediately after the execution.

2.5. Progress

Each gymnast was subjected to a recognition test consisting of three questions:

- **First question**

The student should recognize the front roll among five different spinning motions: the back roll, the held back followed by a roll forward, two rolled jumps and the roll forward. Each movement was represented by a succession of five or six silhouettes viewed in profile.

- **Second question**

Eight silhouettes seen in profile, isolated, each representing a particular moment of the roll were proposed to the student. Six of them contained an error, two were correct. The errors were of the same nature as in the suites. Two silhouettes (two false ones) corresponded at the beginning, when the student put his hands on the ground; four silhouettes (one fair and three false) represented the moment when the hips started the rotation and a silhouette (just) when the rotation ended. We maximized the moment when the hips started rotating because the student, when performing the movement, had no visual cues. We weighted the errors by introducing three unbundling errors and three asymmetry errors. And we have maximized distal errors. We sought to identify, first of all, whether students were able to correctly judge a single silhouette presented outside a suite.

- **Third question**

finally, 12 suites have been spread out, each representing a complete front roll cut into 6 successive profile views. Only certain positions contained unevenly distributed errors in four categories (unbundled, asymmetrical, distal and proximal). The pupil was instructed to color in red the parts of the body which he considers to contain these errors.

This test and its counting system were developed in three surveys. The purpose of these surveys was to build progressively the drawings best adapted to the child's understanding and most resembling the movement studied. He was referring to what we called the "good form" or "bad shape" of the roulade (in the sense of the Gestalt theory) (Köhler, 1929). The good shape was essentially characterized by a profile silhouette running the roll, the limbs were bent, the back was curved and a "single" upper or lower limb was drawn. Recognition of "unique" limb flexion and curvature could be a reflection of the images presented or the demonstration of the "grouped" in the roulade, the "two-handed thrust" or the "two-footed reception" that characterized the teaching of this movement. The good form would correspond to the good gesture taught. As soon as the form "non-curvature" appears there would be search for error of "unbundled" and as soon as a second arm or a second leg appear, there would be search for errors "asymmetry". The errors were primarily identifiable in the parts distal of the body. Hips, for example, which were essential in the kinematic analysis were not among the significant indices of "good form".

A motor performance test (systematic observation grid) of the front roll has been constructed to list all the execution errors of this movement. It was established by a group of experienced EPS teachers. During preliminary soundings, three different observation grids were applied successively and gradually refined. Each observation was preceded by an observer learning in a controlled situation. For reasons of the observer's attentional abilities (memorization of errors and attention to the details of movement on the part of the judge), the motor performance test consisted of two parts: Part A corresponded to the beginning of the roll (until at the moment when the feet leave the ground, the observables are divided into 5 categories) and the part B corresponded to the end of the movement (rotation on the back, until the complete recovery of the body, the observables were divided into several categories):

The five categories of Part A were

- Not squatting at the start (hands too far from the feet, knees stretched);
- Hands not flat (not symmetrical hands too far apart, arms extended);
- Head not tucked in (poses the top of the head, head does not touch the ground, etc.);
- Regrow with the feet after the head is placed (push of the feet not simultaneous, etc.);
- Asymmetry of the axis of rotation (turns on a shoulder).

The four categories of Part B were

- Asymmetry of the axis of rotation (off-axis basin);
- Ungrouped position (relaxed legs outstretched legs, flat back);
- Raise with help (bring the buttocks closer to the feet, push away with the knees apart hands, etc.);
- Imbalance (front, back, side).

2.6. Data processing

Recognition test

The following indices have been selected

- question 1: the number of pupils to have recognized the roulade;
- question 2: for any given position, the number of students to have chosen the correct answer (right or wrong);
- question 3: we defined two categories of answers:
  - right answers (the error has been fully or partially identified);
  - false answers (the error was not identified at all or a correct part was found to be false).
  - Driving performance test:
  - In order to analyze the results obtained, we divided the 38 observables into four different types of errors (Table 1).

Table 1: Number of characteristic roll-forward errors (motor performance test) in category.

	Proximal	**Distal**	**Total**
Asymmetry	8	9	17
Unbundled	12	9	21
Total	20	18	3

The analysis of the results according to these four categories of errors makes it possible to highlight the evolution of the procedures of execution according to the school age of the pupils.

3. Results

Recognition test

- Question 1: Table 2 shows the number of students who identified the front roll among other rotational movements at two different times (before and after execution).

Before execution, only half of the primary pupils (6-7 years) can identify the front roll of the other movements described, while the students of the school (17-18 years) distinguish without difficulty the front roll. Primary school pupils (6-7 years old) benefit from the execution, since, during the second application of the questionnaire, it makes up for the recognition of this movement.

Table 2: Number of students by grade level to have recognized the front roll among other relationship movements before and after execution.

	Elementary school (6-7 years)	**Middle school (14-15 years)**	**High school (17-18 years)**
Before execution	6	12	15
After execution	13	13	14

Question 2: Table 3 represents the average number per gymnast of correct answers by age group and before-after learning in all positions.

Table 3: Average number of correct answers given to question 2 by grade level, before and after completion.

Elementary school	Middle school	High school
(6-7 years)	(14-15 years)	(17-18 years)

It appears from this table that this question does not discriminate between school levels. A slight effect of the experimental situation is observed for the school.

Question 3: The results show that the wrong answers are two to three times higher for the two grade levels of the younger students than the correct answers (Table 4). In addition, there is not always a one-to-one correspondence between correct and false answers, that is, a student with a high number of correct answers may, in some cases, also have a high number of answers. false. The trend is, however, towards the reversal of totals.

Effects of school age

Just Answers: A univariate analysis of the number of correct responses produced showed that the effect of school age was significant ($F (2.42) = 7.07, p < .002$); Duncan's test, from high school level, stands out from the other two groups.

Table 4: Average number of correct and false answers, given in question 3 by grade level, before and after execution.

	Primary school (6-7 ans)	Middle school (14-15 ans)	High school (17-18 ans)
Before execution Correct answers			
Average	3,4	4	6
Standard deviation	2	2,4	1,8
Before execution False answers			
Average	18	15	9
Standard deviation	8,1	7,2	2,5
After execution Correct answers			
Average	4,5	5,1	6,8
Standard deviation	2	1,8	1,7
After execution Correct answers			
Average	16,3	13,1	8,2
Standard deviation	7,3	4,2	2,9

False answers: This variable decreases linearly with school age (F (2.42) = 10.65, p <.0002).

Effects of repetition learning

-Correct answers:

We tested the difference before and after execution using a T-TEST for paired samples. These analyzes showed only trends: primary school: p <.047, Middle school: p <.062, high school: p <.057. The first grade level seems to benefit the most from the repetition of the front roll.

- False answers:

We also applied the T-TEST for paired samples: elementary school: p <.306, Middle school: p <.307, high school: p <.023. We note that only the grade level college (14-15) years benefits from the execution of the movement.

Driving performance test

This analysis focuses only on the effects of school age. In particular, it analyzes the evolution of errors and execution procedures.

- Total number of errors

The percentage of agreement in Part A is 94.5% and in Part B is 91.8%. The average fidelity index of Bennett is 0.915. The coefficient of agreement being high we were able to cumulate the two parts during the statistical processing. Table 5 describes the evolution of the average total number of errors per grade level.

Table 5: Average number of total errors in the motor performance test by grade level.

	Primary school (6-7 years)	Middle school (14-15 years)	High school (17-18 years)
Average	58	28	15
Standard deviation	12,3	14,3	11,7

The three grade levels are well differentiated; (F (2.42) = p <.0001). We also estimated the contrasts between the three grade levels using the Scheffe procedure (1999). This analysis shows that students in the middle school level (14-15 years) are significantly different from students in high school (17-18 years old), and pupils in primary school (6-7 years) are distinguished from two other groups.

-Comparison beginning and end of the movement

We also compared the number of errors observed at the beginning of the movement (part A) with the number of errors observed at the end of the movement (part B). We calculated, for each group, a T-TEST on paired samples. The difference between the beginning and the end of the movement is significant for the first two grade levels (primary: t (14) = -5.99, p <.000, college: t (14) = -4.20, p <.001), on the other hand, it is not so for the high school level: (t (14) = -1.31, p <.209).

-Evolution of enforcement procedures according to school age

We ended with an analysis of the number of errors specific to the four categories (proximal, distal, asymmetric and unbundled) by combining the beginning and the end of the movement. We present below the category-weighted total errors for the three grade levels in these four categories (Table 6).

The weighting was done by dividing the total errors by the number of items constituting each category.

The total number of errors varies with school age (Chi2 to 2d.1 = 18.75, p <.0001). Middle school students make twice as many errors as high school students. As for the total number of errors for each procedure, it appears that the unbundled errors are twice as frequent as the asymmetry errors. We also find that it is the proximal errors that slightly dominate the distal errors (on the set: Chi2 to 3 d.1 = 13.425, p <.0038).

By analyzing the procedures by school age, we find that

- primary pupils make more errors in disaggregation with more pronounced proximal errors (Chi2 to 3 d.1 = 11.625, p <.0087);
- Middle school students have strategies similar to high school students (disaggregated errors).

Table 6: Number of Weighted Errors by Category for Three Grade Levels and by Execution Procedure (Proximal Unbundled, Distal Unbundled, Proximal Asymmetry, Distal Asymmetry)

	Proximal Unbundled	Distal Unbundled	Proximale Asymmetry	Distal Asymmetry	Total
Elementary school (6-7 ans)	30,25	23,8	17,25	9,6	80,90
Middle school (14-15 ans)	13,3	17,7	13,85	6,3	51,15
High school (17-18 ans)	8,9	9,1	11,25	6,6	35,85
Total	52,45	50,6	42,35	22,5	167,9

With a tendency although not significant to have more difficulties in the distal part (Chi2 to 3 d.1 = 5.287, p <.1511),

- High school students make fewer mistakes and manage to balance asymmetry and unbundling.

Discussion

We will successively comment on the effect of school age and the effect of repetition learning on the ability to identify the "good" and "right" shape of the front roll (rotating body) in the test of recognition and the effect of school age only on the ability of these same students to produce a movement as consistent as possible with an implicit model. We recall that the subjects are all students and are therefore familiar with the front roll as required in sports gymnastics.

The evolution of the pictorial representation, highlighted by the recognition test, is effective only for high school students (17-18 years old). At around 14-15 years of high school level, the results of the students in the recognition test still have a high dispersion, a sign that can be interpreted as a temporary disorganization of representations. This interpretation is consistent with that of Hay (1979), and that of Mounoud et al. (1985), Zanone et al. (1992). According to these authors, this would be a period during which recalibration of perceptual-motor coordination takes place.

Taking inspiration from Mounoud's model (1983), we can give some interpretative elements:

- The schemas available to primary school pupils (6-7 years old) use isolated and incomplete representations. The observed roll performance errors follow a monotonous growth throughout the movement. On the "ideatory-analytical" level, elementary students do not recognize the correct reference in the complex iconographic part (sequence of silhouettes), the errors of the execution of the roulade are also badly identified. On the other hand, students are the most successful at question 2, where silhouettes are isolated from their context.
- When the representations available to the pupil are complete but overall at the secondary school level (14-15 years), the representations are rigid. The observations of PS teachers show that students achieve better proximal control (hip flexion), while the distal parts remain ungrouped. The ideational capacities are groping, which leads to a high dispersion of the results.
- The school level of high school students (17-18 years old) seems to have acquired coordinated and well-differentiated representations. Direct observation shows that execution errors are balanced throughout the execution of the roll. At the same time, the "idea-analytic" skills are more efficient and the students are able to identify a standard of the roulade before satisfactorily.

In light of the above, we safely say that our results also showed that when pictorial representations are coordinated and well differentiated, high school students aged 17-18 are learning by repetition and succeed. to improve their pictorial representation of the front roll in rotational movement.

When pictorial representations are isolated, middle school students aged 14-15 are also likely to make some progress, but not significantly.

On the other hand, when pictorial representations are crude, pupils aged 6-7 at the primary school level do not benefit from the repeated only for an overall recognition of the front roll, ie the recognition of the roll among other rotational movements (question 1).

However, the results obtained using the motor performance test highlight an effect of school age on the quality of execution of the front roll. The number of errors identified by observers drops sharply at school age 6-7years. This quantitative transformation is accompanied by a transformation of the execution procedures of the roulade. Elementary school students aged 6-7 years make a multitude of errors in the proximal unbundling (hip opening) by what they identify as less iconographic representation. Because, their action to the motor control is inefficient. In this regard, Schmidt (1988) reveals that learning concerns the acquisition of motor skills, theories which are concerned with the construction of skill. The motor control of the pupils, concerns him, the production the rolling forward, movement of the family of rotations, that is to say the way in which are produced and corrected the rolls necessary to the resolution of an engine problem posed by the environment gymnastics.

Also, the ecological theories reveal that at this level of motor learning the central cognitive treatment is not necessary, and especially not the pictorial representations, iconographic and according to which the roulade emerges directly from the constraints of the gymnic environment, it that is perception is fundamental to motor control. In addition, the concept of a motor program is used to describe the processes that lead primary school children aged 6-7 to develop a powerful motor response. This concept was developed by Keele (1968), taken up by Adams (1987) and then by Schmidt (1993).

For Keele (op.cit), the student's running program of the roll is a series of structured muscle commands before the start of the motor sequence that allows the entire roll to be performed without being influenced by the peripheral feedbacks. It would be a predetermined organization of the roulade. The idea is that there is a predetermined organization of the movement before its production, and the specification of all the parameters (motor units, order, timing). We say that the performance threshold of the pupils' academic level is reached, that is to say that the level of the execution of the roll does not vary more than infinitely, a method of analysis of the secondary tasks can be used. In this case, the independent variables of the front roll are, for example, the latency time, the attention, effort, retention and generalizability measures.

Finally, a last method, which we applied in our study and which corresponds to the transfer of learning, is characterized by the increase (or the decrease) of the capacity to answer a task, this one being the result of the practice or experience of another task (Schmidt, 1993). While college-grade students aged 14-15 tend to keep the hips bent, but to ungroup the distal parts (lower and upper limbs).

Definitely, our data is compatible with our goal which states that there is a link between action and pictorial representation through development: the more the student is able to perform a quality roll, the more he is able to identify a representation. iconographic correct of this roulade. This humanization of production skills and recognition of the same roulade begins at school age 14-15 years and stabilizes at school age 17-18 years.

Conclusion

This study aimed to compare the pictorial representation of the rotational movement of the front roll with the execution of this same roll. The research paradigm for imagery and motor skills has been verified in the hope of gaining a better understanding of the relationship between student representation, motor skills and level of expertise from a developmental perspective. This work also allowed us to analyze students' ability to identify the specific errors of a complex motor act such as the front roll. As a corollary, his errors of execution of the roulade highlighted by the teachers of EPS can be without doubt, transferred to an instrument of evaluation of the capacity of representation of the pupils. As proof, our results show that the front roll recognition test is effective only for high school students aged 17-18 years and the motor performance test has highlighted an effect of school age on the quality of movement performance for primary school age students aged 6-7 years. This implies that school age pictorial representations have an influence on the learning of the front roll in gymnastics.

Reference

1. Adams AJ. Psychological bulletin, 1987, 29.
2. Bernstein NA. The coordination and regulation of movement Pergamon Press, London. Champaign, IL: Human Kinetics Publishers, 1967.
3. Cooper LA. Demonstration of, mental analog of an external relation, Perception and Psychophysics. 1976; 19:296-302.
4. Corballis MC, McLaren X. Interaction between perceived and imagined motion, Journal of Experimental Psychology: Human Perception and Psychophysics 8, 1. 215-224. Denis, M. (1989). Image and cognition, Presses Universitaires de France, 1982.
5. Hauert CA. Developmental psychology: cognitive, and neuropsychological perspectives, Elsevier Science Publishers, North-Holland, 1990.
6. Hay L. Spatial-temporal analysis of movement in children: motor program versus feedback in the development of reaching, Journal of Motor, Behavior. 1979; 11:189-200.
7. Keele SW. Movement control in skilled motor performance, Psychological Bulletin, 1968, 31.
8. Köhler W. Gestalt psychology, Liveright, New York.
9. Laszlo, If, & Bairstow, P.J. (1985). Perceptual-motor behavior, developmental assesment and therapy, Holt, Rinehart and Winston, East-bourne (GB), 1929.
10. Lautrey J. Unity or plurality in cognitive development. Relationships between mental image, action and perception, in G. Netchine-Gryndberg (Ed.), Functional development cognitive in children, University Press of France, Paris, 1990.
11. Lautrey J, Chartier D. Mental Images of Transformations and Cognitive Operations: A Critical Review of Developmental Studies. The Psychological Year. 1987; 87:581-602
12. Manidi MA. The development of a complex movement in children: a kinematic and psycho-pedagogical approach, Unpublished doctoral thesis, University of Geneva, 1990.
13. Mounoud P. The evolution of understanding behaviors as an illustration of a development model, in S. de Schönen (Ed.), Development in the first year, 1983.
14. Mounoud P, Viviani P, Honda CA, Guyon J. Development of visuo-manual tracking in the 5 to 9 years-old boys. Journal of Experimental Child Psychology. 1985 ; 40:115-132.
15. Paillard J. The treatment of spatial information, in, From the body space to the ecological space, Symposium APSLF, Paris, PUF, 1974.
16. Piaget J, Inhelder B. The psychology of the child, Paris, PUF, 1966.
17. Piaget J. The psychology of intelligence, Paris, Armand Colin, 1967.
18. Piaget P. Succeed and understand, Paris, PUF, 1974.
19. Scheffe H. The Analysis of Variance Paperback - 19 February, 1999.
20. Schmidt RA. Motor control and learning. A behavioral emphasis (2nd Edition), 1988.
21. Scmhid RA. Motor Learning and Driving Performance, VIGOT, 1993, 32.
22. Serre JC. Dance among other forms of motor skills, Research in Dance. 1984; 3:135-156.
23. Zanone PG, Kelso JAS. Evolution of behavioral attractors with learning: Nonequilibrium phase transitions. Journal of Experimental Psychology: Human Perception and Performance. 1992; 18:403-421.