Effects of Instructional Focus on Learning a Classical Ballet Movement, the Pirouette

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Abstract
This study investigated how changes in the focus of instruction might affect the learning by individuals who are not trained dancers of a complex classical ballet movement, the pirouette. Seventy-two volunteer college students were divided into six groups according to the focus of instruction: 1. head, 2. arms, 3. trunk, 4. knees, 5. feet, and 6. controls. In the acquisition phase, all groups performed 160 trials, over 2 consecutive days. At the beginning of each day, they received verbal instruction regarding some of the general principles involved in performance of the pirouette and viewed a video that illustrated those principles. Each group (head, arms, etc., exclusive of controls) was then given specific directions for controlling focus on its body part while performing the movement. After a week, all participants were asked to complete a retention test, with no additional instruction. The trials were videotaped with two cameras (frontally and laterally), and the results were analyzed by 10 specially trained examiners, utilizing Movement Pattern and Error of Performance measures. They revealed that all groups improved in the acquisition phase, and the improvement was maintained in the retention test. No differences were revealed between groups. It was concluded that generalized instruction in basic principles of the movement was more effective than focus on specific body parts in the teaching and learning of the pirouette.

For hundreds of years classical ballet has attracted a devoted following, due largely to its aesthetics, visual body language, and the coordination and accuracy of movement it requires. Within the wide range of ballet motor skills, the pirouette is known for the challenge and complexity it represents. The Royal Academy of Dancing defines the pirouette as a rapid, complete turn of the body around the longitudinal axis on a single foot. Recently, researchers in the field of motor behavior have investigated the importance of visual and vestibular information to postural control during the performance of the pirouette. Resulting studies have revealed that, during the performance of a motor skill such as the pirouette, head movement seems to be a critical aspect because it helps to provide postural control during the turn. It has been argued that the head movement stabilizes the vestibular and visual systems, which use sensory information to control the position and movement of each body part.

While knowledge about the performance of the pirouette continues to develop, there appears to be an absence of research related to how this motor skill actually emerges from practice and experience—that is, how it is learned. The purpose of the current study, therefore, was to investigate the learning of this important skill that is so relevant to the initial training of dancers, based on principles of motor skill learning.

Of particular importance to this study are task characteristics. They can reveal how a task is compounded and organized, and how its components interact during the learning process. Also, knowledge about the characteristics of a particular motor skill helps teachers who intend to teach the skill determine the most appropriate method. Naylor and Briggs considered organization and complexity to be two key motor skill characteristics. Organization refers to the interaction of a task's parts or components, and complexity refers to their number. The investigators claimed that it is important to emphasize organization while teaching low-complexity and high-organization skills and conversely to emphasize complexity while teaching high-complexity and low-organization skills. For skills that involve intermediate levels of...
complexity and organization, they recommended a combination of both methods.

By these definitions, the performance of the pirouette is both a highly complex and highly organized skill. It involves the simultaneous coordination of five body components: head, arms, trunk, knees, and feet. Foci on the critical-task aspect or relevant-task information have proven to be promising alternatives in investigations of the learning of other highly-organized and highly-complex skills. It seemed reasonable to ask, therefore, which components constitute "critical-task aspects" in learning the pirouette. To explore this question, the investigators experimentally manipulated their instructional focus on the dynamic of each task component of the pirouette, because it is through the instructional process, primarily, that task-relevant information is transmitted. That is, we sought to understand the process of learning the pirouette by focusing on instruction as it related to the individual components. Based on previous studies of pirouette performance, we hypothesized that instruction that focused on the head component would be most critical to the learning of the pirouette; that head movement was such a crucial aspect of the learning process that it would supersede all of the other task components. Ultimately, identifying how each component interacts to form the pirouette skill, and which aspects are critical to learning can provide insights to the development of a logical sequence of teaching-learning activities.

Methods

Participants

Although it might be argued that teaching the pirouette to absolute beginner dancers is questionable pedagogic practice, a characteristic of motor learning studies is application of the treatment under investigation to individuals with no previous experience to allow for a relatively uncontaminated understanding of the learning process. Hence, for this study, the recipients of instruction were not trained ballet dancers.

Seventy-two college students, both women (N = 36) and men (N = 36), with a mean age of 25.8 years (SD = 6.9) and no experience in classical ballet, volunteered to take part in the experiment. All participants gave their written informed consent, as approved by the local ethics committee.

Task

The task to be performed was pirouette en dehors from fifth position. This motor skill is composed of the interaction of five simultaneous movements by five body components: head, arms, trunk, knees, and feet. Relative to skill characterization, these components are utilized in each of the five sequential phases of the pirouette: 1. preparation, 2. plié, 3. beginning of the turn, 4. ending of the turn, and 5. finalization (Fig. 1). For this study, the support (base) leg was the left leg (L), and the right leg (R) was the gesture leg.

The preparation phase (1) consists of maintaining the head straight with eyes fixed on a distant point. The head movement is called spotting, implying a turning of the head. The eyes must remain as fixed as possible relative to the spatial reference, so they are the last element—after trunk and head—to leave their original position, and the first to find it again as the trunk and head complete the turn. The elbows are semi-flexed, while the hands are held near the thighs (bras bas). The trunk is stable, with shoulders and hips aligned. The hip joints should be in maximum external rotation for all movements. The knees are extended, and one foot is crossed in front of the other, with heels and toes on the floor (fifth position, defined by a heel aligned with the opposite ankle bone).

In the plié phase (2), the head, the trunk, and the feet continue in the same position as in (1), while one arm (semi-flexed) is raised in front of the umbilicus (without touching it), and the other is held perpendicular to the side of the trunk, also semi-flexed (third position). The knees are flexed (plié), and the hip joints are externally rotated.

At the beginning of the turn (3), the eyes stay focused on the fixed point, while the head turns. The arms are flexed in first position, and the trunk is stable. It is important not to move the shoulders and hips and to maintain the alignment steadily as the gesture foot is raised and the gesture knee is extended, while the base knee is straightened, forming the "number four." The toes of the base foot are on the floor, and the heel is raised (demi-pointe). The gesture foot is pointed toward the base knee.

The ending of the turn position (4) is equal to that of the previous phase (3) for the arms, trunk, knees, and feet, with the eyes returning to the fixed point after the turn but before the head arrives.

In the finalization phase (5), the head returns to the same position as in (1) and (2), the arms and trunk

Figure 1 Pirouette en dehors from fifth position: 1. preparation, 2. plié, 3. beginning of the turn, 4. ending of the turn, and 5. finalization.
continue in the same position as in (3) and (4), the knees return to the same position as in (2), and the feet return to the same position as in (1) and (2) but with the opposite foot in front (left for this study).

**Design and Procedures**

The experimental design involved six groups of 12 participants each, which reflected the instructional focus: 1. head, 2. arms, 3. trunk, 4. knees, 5. feet, and 6. controls. In the acquisition phase, all participants performed 160 trials divided into eight blocks of 20 trials over 2 consecutive days (four blocks of 20 trials per day). At the beginning of each day, the participants were given verbal instructions about the general characteristics of pirouette performance, and they also were shown a video that illustrated those characteristics. During the trials, the participants received specific instructions for their group between each five trials (i.e., four times per block). A week after the acquisition phase all participants performed a 20-trial retention test, with no additional instruction. The design respected the need for rest (2 days of practice and 2 minute rest at the end of each 20 trial block) since rest has a beneficial effect on learning complex dance motor sequences.

The specific instructions for the experimental groups were as follow:

1. Head: “Concentrate on your head! Do not lose the fixed point. The head movement must be the last segment to start and the first to finish the turn!”
2. Arms: “Concentrate on your arms! They must move upward, with the right arm raised to the front and the left arm to the side; then they must meet, away from the body.”
3. Trunk: “Concentrate on your trunk! Keep shoulders and hips aligned during the entire turn; hold the belly and gluteus!”
4. Knees: “Concentrate on your knees! They must be extended to start; then they must flex; during the turn they should form the number “4,” and they must flex at the finish.”
5. Feet: “Concentrate on your feet! The right foot must begin in front, rise toward the left knee, and then drop back down. The left foot's heel is raised during the turn!”
6. Control: No specific instructions.

Ten performances were recorded using two digital cameras (SONY Cybershot - DSC H9, frequency = 30 Hz), which were located in front of (frontal) and at the side of (lateral) the participants to capture their displacements. Data were analyzed from the first and last trials of the first and last blocks of each acquisition day and from the first and last trials of the retention test.

**Statistical Procedures**

The recorded data were analyzed using Kinovea 7.10 and Ulead Video Studio 11 software for images. The analysis utilized two dependent variables, Movement Pattern and Error of Performance.

As the performance of each component (head, arms, trunk, knees, and feet) involved five phases from start to finish, Movement Pattern was evaluated by summing the correct performance of each component in all of these phases. Thus, each turn could score a maximum of 25 points. Scores of the first and last performances of each block of trials were used in the analysis. Any movement performed in accordance with the above task description was considered to be “correct.” A scoring checklist, which contained a description of each component in each phase, was constructed and validated. Ten examiners, two per component, were trained to analyze the participants' performances. During the analyses, the examiners were not aware of the participants' group or trial numbers, and two random trials were evaluated twice by each examiner. Spearman's correlations for intra-examiner were verified and were greater than r = .7 (p < 0.05).

The Error of Performance was the number of pirouettes performed on the opposite side of that requested (i.e., in the wrong direction) or on the wrong leg.

**Data Analysis**

All analyses included the four acquisition trial blocks and one retention block. In order to investigate the effects of instructional focus on the learning of pirouette, 6 x 5 mixed-model ANOVAs were conducted on data from Movement Pattern for Groups x Blocks. For Error of Performance, Friedman χ² and Kruskal-Wallis tests were used to analyze intra- and inter-group effects, respectively. All analyses were preceded by Shapiro-Wilk's and Bartlett's tests of normality and homogeneity of variance. For all analyses, STATISTICA® 9.0 software (Stat Soft Inc., Tulsa, Oklahoma, USA) was used, and the level of significance was p < 0.05.

**Results**

**Movement Pattern**

The 6 x 5 mixed-model ANOVA (Groups x Blocks) did not reveal effects for Groups (F[5, 66] = .57, p > 0.05, η² = .04) or for interaction (F[20, 264] = 1.32, p > .05, η² = .09). For Blocks, the ANOVA produced the following results: F(4, 264) = 35.03, p < .01, η² = .35. The Tukey test showed that the performance of the first block was inferior to those in the succeeding blocks (p < 0.05). It was also found that the performances in the second and third blocks were inferior to the performance in the fourth block (p < 0.05), (Fig. 2).

**Error of Performance**

The Friedman tests conducted for all groups revealed the following results:

\[ \chi^2(4, N = 12) = 9.68, p < 0.05 \] (head);

\[ \chi^2(4, N = 12) = 11.06, p < 0.05 \] (knees);

\[ \chi^2(4, N = 12) = 6.50, p > 0.05 \] (arms);

\[ \chi^2(4, N = 12) = 3.50, p > 0.05 \] (trunk);

\[ \chi^2(4, N = 12) = 8.50, p > 0.05 \] (feet); and

\[ \chi^2(4, N = 12) = 6.14, p > 0.05. \]

It was observed that the Error of
Performance for the Head and Knees groups decreased from the first block to the last acquisition trial block and retention block (p < 0.05), (Fig. 3).

The Kruskal-Wallis test did not reveal effects for inter-group comparisons in the first, second, third, and fourth acquisition trial blocks and the retention trial block, respectively:

\[ H(5, N = 72) = 7.81, p > 0.05; \]
\[ H(5, N = 72) = 9.09, p > 0.05; \]
\[ H(5, N = 72) = 2.58, p > 0.05; \]
\[ H(5, N = 72) = 3.45, p > 0.05; \text{ and} \]
\[ H(5, N = 72) = 2.54, p > 0.05. \]

Discussion and Conclusion

This study aimed to investigate the learning of the pirouette based on instructional focus on its component parts. Specifically, it was intended to verify whether there exists a single component that is critical to learning this complex movement. Considering that the head movement provides stabilization and balance to the vestibular system throughout the performance of the task, it was hypothesized that it would prove to be the critical component. However, the results of the study indicated no difference in learning between groups focused on different body parts, refuting this hypothesis.

All of the groups appeared to learn to perform the pirouette similarly, as they showed improvement from beginning to end of the acquisition phase and also maintained the same level of performance in the retention phase. Interestingly, these results were observed for both performance measures (Movement Pattern and Error of Performance).

Important questions that remain, therefore, are why instructional focus on different components did not affect participants' learning of the pirouette and why the results for foci on different components were similar to those for no specific focus (the control group condition). One possible explanation is suggested by the relationship between task and learner characteristics and by an understanding of what was learned and by whom.

With regard to the nature of the task, the pirouette is understood to be highly complex and organized, with the movement pattern itself—closed and discrete—as the outcome. Therefore, it can be assumed that performance of the pirouette requires high attention level and cognitive capacity in order to assemble its composite components correctly. Perhaps the participants themselves, who were beginners without any prior experience in performing the task, were unable to focus on individual components, causing them instead to rely on the general instructions they had received.

The first stage of learning has been well described in the literature. From a cognitive perspective, learners need to understand the general characteristics of a given task, and limited attention ability can prevent them from identifying relevant stimuli for action. From a dynamic perspective, it is necessary at the first stage of learning for the learners to search for relationships among key task components; that is, they must assemble coordination patterns among relevant components. The investigators suspect that the participants in this study focused on the coordination process itself (i.e., interaction between the components), which took attention away from the individual components. Perhaps the learners needed only general instruction, that is, the general characteristics of the movement, to improve their performance. This seems reasonable as beginners are known to have difficulty in identifying relevant information.
Concerning attention, there is research on motor learning that involves two different aspects of the subject. On the one hand, there is the movement pattern aspect, which is internally focused and relates to performance itself in terms of thoughts and feelings about performance. On the other hand, the externally focused environmental aspect relates to information about the result of the action within the environment.  

While the external focus allegedly plays a larger part in shortening the first stages of learning, when used with pirouette learners neither of these two foci produced superior results. All of the study components promote attention directed to internal focus (performance of the turn and idea of performance), except for the head component, which directs attention to information from the environment (spotting—i.e., external focus). This, then, reinforces the suggestion that general instruction was enough in the initial stages of pirouette learning.

Characteristics of these participants' cumulative learning curve lend support to the above assumptions related to the initial stage of learning. Theirs was the "negatively accelerated curve" that is typical of beginners. This type of curve demonstrates great improvement in performance at the start of practice compared to later.  

Dramatic improvement in the first trials clearly shows that simply understanding what is involved in the task at hand enhances performance.

Additionally, the results for Error of Performance support Laws' observation that the pirouette is a difficult skill to learn. Some participants performed trials using the wrong side of the body or the wrong leg. Regarding movement direction, it is known that inexperienced dancers show less specific control than do experienced dancers. This is because dance training tends to increase use of the kinesthetic sense, which influences choice of spatial direction. At final practice, the groups' performances related to movement patterns were only about 60% of the potential maximum score.

In summary, the findings of the current study lead to the conclusion that general focus of instruction provided beginning dancers with the information required to learn the complex pirouette task. As noted earlier, the results of this study might be called into question because the teaching of pirouettes to beginning dancers is not common practice. Nonetheless, what the study indicates is that beginners are able to learn this motor skill, and for that purpose general instruction can be an important asset. Thus, the practical implication of these results is that teachers of young dancers should emphasize general instruction in order to promote an overall comprehension of movements, such as the pirouette, on which subsequent assembly of the coordination pattern can be based. Further investigations might analyze how dancers with more advanced knowledge benefit from a more specific instructional focus.

References

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