Conceptions of Ability Influence the Learning of a Dance Pirouette in Children

Natália Maass Harter, MS, Priscila Lopes Cardozo, PhD, and Suzete Chiviacowsky, PhD

Abstract

Conceptions of ability induced by instructions or feedback have been shown to influence motivation, reactions to failure, and learning in various populations. Few studies, however, have examined such effects on motor learning. The present study investigated the influence of conceptions of ability on the learning of a dance pirouette in 10-year-old children. Two groups of participants were given either acquirable-skill (AS) or inherent-ability (IA) instructions before they began practicing the dance skill. All participants performed 15 practice trials of a (right) pirouette in which the objective was to rotate as far as possible in a circle divided into eight equal sections, where the dependent variable was the number of sections rotated. One day later participants completed retention and transfer (left pirouette) tests, five trials of each, without ability conception instructions. The induced conceptions of ability affected children's motor learning differently, with AS participants consistently scoring higher. These results demonstrate the advantage of using acquirable versus inherent conceptions of ability to promote the learning of dance skills in particular and add to the growing body of research demonstrating the importance of socio-cognitive-affective variables in motor performance and learning generally.

There is general agreement that the learning of new motor skills is a critical aspect of life, from birth to old age, and that motivation plays an important role in the learning process. Various studies have demonstrated the beneficial effects of instructional environments supporting learners' competence,[1,2] autonomy,[3-5] and relatedness needs[6,7] in the learning of motor skills. Competence, autonomy, and relatedness are considered to be basic necessities for promoting human psychological growth, integrity, and well-being,[8,9] and have been acknowledged as providing a useful framework for exploring motivational factors in motor learning research.[10] Supporting these innate needs means, respectively, the provision of conditions that facilitate individuals' experiences of freedom, feelings of success in relevant skills, and sense of belongingness and connectedness to persons, a group, or a culture.

The importance of individuals' perceptions of competence for motor learning has been emphasized in different lines of research, for example when comparative feedback suggested improvements across blocks of practice[11] or better-than-average performance.[12-15] Participants in these studies who received positive temporal or social-comparative feedback in addition to veridical feedback, leading them to believe that their performance was improving or above average, learned better than participants receiving negative comparative feedback or control participants not provided with any comparative indication. Using performance criteria that allow learners to overcome challenges with a relatively high degree of success during practice has also been shown to benefit motor learning.[16-19] Most of these studies were based primarily on previous observations showing that learners prefer to receive feedback after more successful rather than less successful trials,[3,20,21] and feedback provided after good instead of bad trials indeed did benefit motor learning.[1,22-24]

A similar line of research involves the learner's conception of ability, or competence.[25] Conceptions of ability are considered knowledge structures and include beliefs about inherent ability versus the changeability of attributes.[26] Being construed as malleable skills, strongly dependent on effort and learning, or as fixed capacities that define the limits of improvement,[27,28] these two conceptions of ability have been shown to affect the performance and learning of motor skills differently. Jourden et al.[29] demonstrated not only greater performance improvement in a pursuit-rotor tracking task but also higher self-efficacy, task interest,

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and positive affect in a group exposed to instruction that emphasized the learnability of a skill compared with a group informed that mastery of the skill measured a certain natural capacity. A subsequent study reaffirmed and extended these results through the learning of a stabilometer balance task.[2]

To date, however, only two studies have examined the effects of different conceptions of ability on children's motor learning.[30,31] Drews et al.[31] observed more effective learning of a beanbag throwing task in 6- to 14-year-old children when the instructions before practice induced performance as a function of practice instead of a result of inherent ability. Chiviacowsky and Drews[30] also found that subtle differences in the wording of feedback affected motor performance and learning of soccer ball kicking and beanbag throwing tasks in children. In this study, generic feedback such as "You are a great soccer player," implying an inherent ability, led to worse performance and learning than non-generic feedback such as "Those kicks were very good," which implies a malleable conception of ability, especially when children made mistakes. Thus, instructions and feedback indicating that performance is malleable, rather than due to an inherent ability, seem to have the potential to benefit performance and learning and to protect learners against setbacks, a development frequently encountered in motor practice contexts.

The objective of the present study was to investigate whether instructions inducing different conceptions of ability would affect the learning of the pirouette, a specific dance skill, in children. As mentioned above, only two studies to date have pursued a similar objective.[30,31] It therefore remains largely unknown how different conceptions of ability affect the learning of complex sport or dance tasks, such as the pirouette. The participants in this study practiced the pirouette after being instructed in different malleable or fixed ability conceptions. One day later they completed retention and transfer (other leg) tests in order to verify learning. We hypothesized that the acquirable-skill group would outperform the inherent-ability group in the learning tests.

Methods

Participants

Forty 10-year-old female children, (mean age = 9.6 years, SD = 0.11) without mental or physical disabilities and with no dance training, participated in the study. Calculation of the sample size was carried out using G*Power 3.1, with an α level of 5%, effect size (f) of .46, and a power of 80% for two groups, based on effect sizes previously reported using similar study designs (e.g., $\eta_p^2 = .06$ in Drews et al.[31]; $\eta_p^2 = .17$ in Chiviacowsky and Drews[30]). The children were recruited from a public school, were naive as to the purpose of the experiment, gave their assent to participate, and informed consent was obtained from their parents or guardians. The institutional review board of the authors' university approved the study.

Task

The task, as described by Silva et al.,[32] required children to learn the pirouette en dehors (from the fourth position), a dance movement consisting of a complete rotation of the body around the longitudinal axis on one foot. While the pirouette is a highly complex motor skill with many criteria for success, we identified the extent of rotation as the single success criterion for this experiment with inexperienced children. The participants were shown a ballet pirouette as an example but were not constrained to the ballet aesthetic as a determinant of success. Each participant began the execution of the practice and retention pirouettes with the left foot positioned in the middle of a circle that was divided into eight equal sections, each representing one point (Fig. 1). Participants' scores were awarded based on the extent of rotation with regard to the direction that the upper body faced when landing the turn. The experiment was conducted in a private room with a wooden floor, the participants wore ballet slippers, the task goal was to rotate as far as possible, and the dependent variable was the number of degrees rotated.

Procedure

Participants were randomly assigned to the inherent-ability (IA) or acquir-

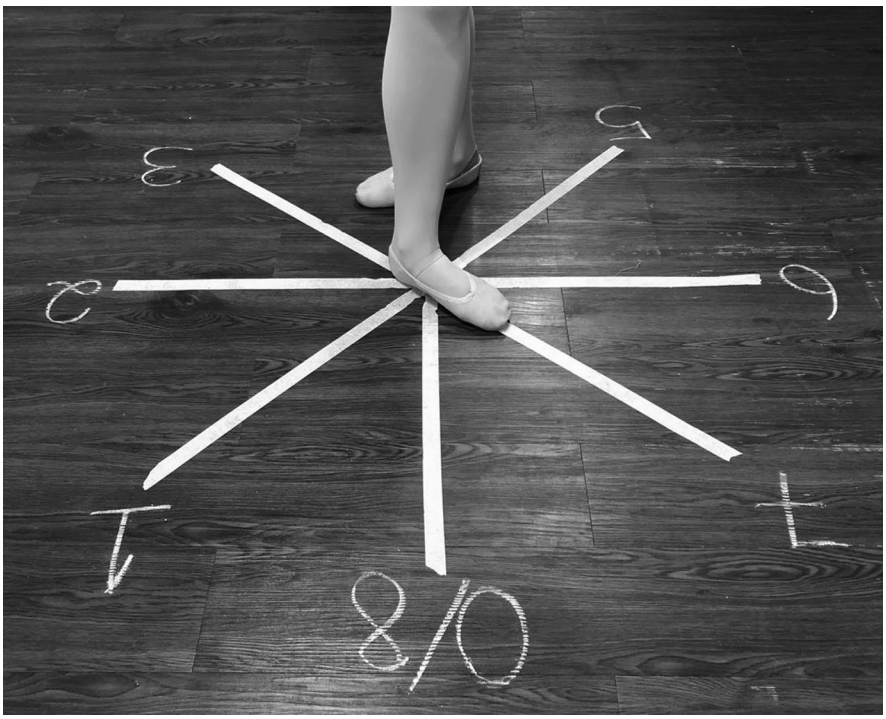

Figure 1 Participants' starting position, with the circle divided into the eight sections used for punctuation scores.

able-skill (AS) condition, resulting in 20 participants in each group. The groups received general instructions about the task and its goal and were told to rotate as far as possible in each practice trial. In addition, they observed a video demonstration of an expert adult dancer performing pirouettes at real-time speed, at slow speed, and again at real-time speed.

After performing two pretest trials, the participants received specific IA or AS instructions, according to their group assignment. Similar to the Drews et al.[31] study, in the IA group participants were told: "This task measures people's ability to perform pirouettes. We will ask you to perform several pirouettes today and tomorrow. Your mistakes or your success on this task will show your ability to perform the pirouette." Participants in the AS group were told: "This task measures people's ability to perform pirouettes. We will ask you to perform several pirouettes today and tomorrow. The pirouette is a skill that can be learned. At the beginning, it is common to make errors, but with practice you can learn and improve." All participants then performed 15 trials and were given ability conception reminders after the fifth and tenth trials: "Remember that performing the pirouette is an ability that you are born with, your mistakes or your success on this task will show your ability to perform pirouettes," or "Remember that performing the pirouette is a skill that can be learned, at the beginning it is common to make errors, but with practice you can learn and improve." Participants were asked not to practice pirouettes between days, and 1 day later they completed retention and transfer tests, five trials of each, without conception instructions or reminders. Immediately after the transfer test, as debriefing, the participants in the IA group received positive feedback and the AS group conception of ability information related to their ability and the pirouette.

Data Analysis

Punctuation scores (one-eighth of rotation as the unit) during the practice phase were averaged and analyzed in 2 (conceptions of ability) x 3 (blocks of five trials) analysis of variance (ANOVA) with repeated measures on the last factor. Least significant difference post-hoc testing was used for follow-up analysis. The average pretest, retention, and transfer data were analyzed in one-way separated ANOVAs. ANOVA with repeated measures on the last factor were also used for comparing the retention and transfer tests with the pretest data. The alpha level for significance was set at 0.05 for all analyses.

Results

Pretest

In the pretest there were no significant differences between the AS (M = 7.625, SD = 0.705) and IA (M = 7.575, SD = 0.654) groups (Fig. 2); $F(1, 38) = .054$, $p = 0.817$, $\eta_p^2 = 0.001$.

Practice

Punctuation scores followed different patterns between groups across practice blocks (Fig. 2), with the AS group showing an increase in scores relative to the IA group. The main effects of block, $F(2, 76) = .206$, $p = 0.016$, $\eta_p^2 = .814$, and group, $F(1, 38) = 1.365$, $p = 0.250$, $\eta_p^2 = .035$, were not significant, but a significant interaction was observed among conceptions and block, $F(2, 76) = 5.669$, $p = 0.005$, $\eta_p^2 = .130$. The AS group showed improvement across blocks of practice, $F(2, 38) = 4.150$, $p = 0.023$, $\eta_p^2 = .179$, while participants in the IA group did not improve, $F(2, 38) = 1.832$, $p = 0.174$, $\eta_p^2 = .088$. Follow-up analysis showed differences in the AS group between block 1 and blocks 2 ($p = 0.018$) and 3 ($p = 0.020$).

Retention

On the retention test (Fig. 2), the AS group (M = 8.110, SD = 1.347) demonstrated higher punctuation scores than the IA group (M = 7.350, SD = 0.845), $F(1, 38) = 4.562$, $p = 0.039$, $\eta_p^2 = .107$. An analysis comparing the retention test with the pretest data did not show differences between the tests, $F(1, 38) = .530$, $p = 0.471$, $\eta_p^2 = .014$, or in the interaction between groups and tests, $F(1, 38) = 3.951$, $p = 0.054$, $\eta_p^2 = .094$.

Transfer

On the transfer test (Fig. 2), the AS group (M = 8.470, SD = 1.181) again showed higher scores than the IA group (M = 7.700, SD = 1.047). The main effect of conceptions of ability was significant: $F(1, 38) = 4.759$, $p = 0.035$, $\eta_p^2 = 0.111$. We also performed a comparison of the transfer test and the pretest data. The results demonstrated higher punctuation scores on the transfer test relative to the pretest, $F(1, 38) = 7.517$, $p = 0.009$, $\eta_p^2 = .165$, and an interaction between groups and tests, $F(1, 38) =$

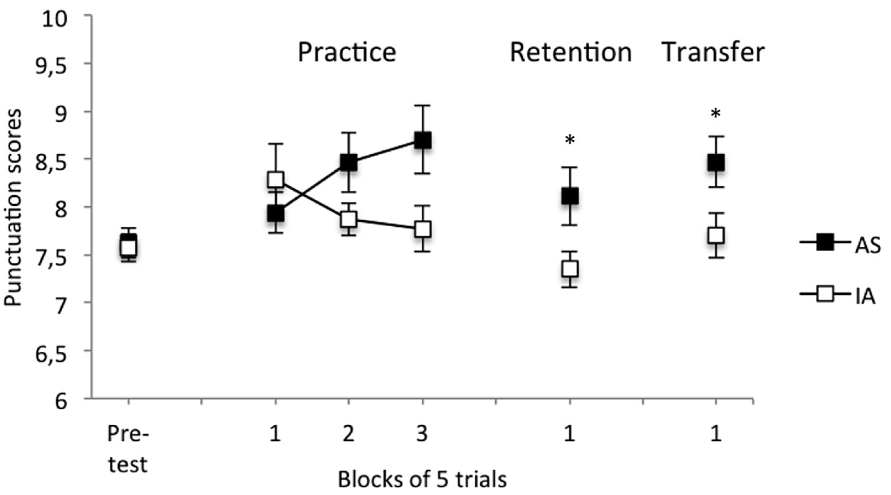

Figure 2 Punctuation scores of the groups during pretesting, practice, retention, and transfer. Error bars indicate standard errors; *$p < 0.05$.

4.141, p = 0.049, η_p^2 = .098. Follow-up analysis showed that the differences were present for the AS group (p = 0.006) but not for the IA group (p = 0.262).

Discussion

Our results demonstrate that children's conceptions of ability can influence the learning of complex motor skills such as the dance pirouette. The AS group outperformed the IA group in both the retention and transfer tests. Thus, instructions inducing the malleability of abilities through practice led to higher learning than did instructions presenting abilities as a fixed capacity. These results are in line with previous motor learning studies among adults[2] as well as children.[30,31] They also add to the evidence from other domains showing that individuals' conceptions of ability can affect performance and learning, such as the effect on grades in junior high school,[33] or learning from error feedback in a general knowledge test,[34] or even mental health.[35,36]

Why do conceptions of ability affect motor learning? It has long been suggested that these orientations have different motivational and behavioral consequences, based mainly on how perceived competence is developed. That is, if competence is developed in a learning involvement context, levels of competence may be judged in relation to one's own perceived mastery, whereas if competence is formed in a performance involvement context, it may be judged with reference to external values.[28,37] As a consequence, individuals viewing competence as malleable and dependent primarily on effort or learning tend to be more intrinsically motivated and focused on task learning, react to difficult situations by increasing effort, and interpret errors as a natural part of the learning process. Conversely, individuals viewing competence as a natural capacity that is relatively stable and defines the limits of potential achievements would probably strive to demonstrate their abilities by outperforming others, avoiding challenging situations that might demonstrate low ability, and showing less effort and persistence when confronted with mistakes.[25,27,28,37-39]

These behavioral reactions have previously been observed in the motor domain when children induced through feedback to acquirable or inherent-skill abilities during practice were presented with negative situations or setbacks, such as the well-known mistakes or performance errors during the initial stages of motor learning.[30] Reduced nervousness, less self-consciousness of body movements, and greater automaticity of motor control were also observed in young adults induced to malleable relative to fixed conceptions of ability.[2]

A malleable view of ability was also observed to be directly linked with positive self-evaluation,[40] including self-efficacy.[29] Greater self-efficacy, in turn, has been found to be a predictor of motor performance[41] and learning.[17,42-44] It also influences effort tolerance and positive affect in young adults,[45,46] increases the importance of doing well and persistence in practicing the task in children,[13] and elevates task-relevant attentional control during practice.[47] Learners presenting less self-efficacy, on the other hand, tend to show reduced effort and attention to or explicit monitoring of important aspects of the task, thereby diminishing their performance and learning proficency.[17,48,49] Highlighting the learnability of a task can, in this way, create conditions that enhance learners' performance expectancies or perceived competence. Such conditions may prepare children for further positive experiences, impacting emotional, cognitive, and motor preparatory activity.[50-53] Enhanced expectancies for performance have recently been acknowledged as a key motivational factor in the OPTIMAL theory of motor learning, possibly by strengthening the coupling of goals to actions, readying the motor system for task execution, and helping to consolidate memories.[54]

Conclusion

Our results are important from both a practical and theoretical perspective. They add to a growing evidence of the important role of motivation in motor learning.[10] They also indicate the importance of how instructions are worded in teaching contexts, since emphasizing the learnability of skills to children not only facilitates their motor learning[30,31] but also encourages them to engage in motor activities.[40] The present study was limited to a simple measurement system, using only the extent of rotation in the pirouette as a success criterion. Follow-up studies might measure performance and learning of the pirouette as a function of conceptions of ability by utilizing movement form analysis. More precise measurements using cameras and appropriate software, for example, could facilitate a more detailed description of the data. Future studies could also observe the effects of conceptions of ability on learning in different contexts and types of motor skills in children.

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