Improvements in Middle-Schoolers’ Performance and Motivation to Practice: An Experimental Investigation of Accurate Feedback in a Motor Task

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Abstract
The present field experiment investigated the effects of accurate and non-accurate performance feedback on causal attributions, success expectancy, performance, and persistence on a motor task. Forty-six male middle-schoolers were randomly assigned to a Contingent (accurate) feedback, Non-contingent (non-accurate) feedback, or Control (no feedback) group and completed a challenging motor task. An initial treatment phase provided either accurate contingent feedback or yoked non-contingent feedback during the task, and measured task performance, attributions about performance, and success expectancy about future performance. A subsequent testing phase (same task) used the same measures and added a measure of motivation (persistence). Compared to the Contingent and Control groups, Noncontingent outcome feedback during the initial treatment phase led to more personally uncontrolable attributions, lower success expectancy, poorer performance, and lower persistence in the subsequent test phase. Despite a high rate of failure in the motor task for both feedback groups in the treatment phase, the Contingent group—getting accurate feedback about performance—had a higher sense of personal control and expectancy of success than the Non-contingent feedback group initially, and maintained these perceptions in the subsequent test phase where they also had better performance and higher levels of persistence than the Non-contingent group. Non-contingent feedback in an initial motor task appears to induce helplessness deficits in subsequent task performance and persistence. In contrast, providing accurate (contingent) feedback about achieved performance appears to protect against performance and motivational losses.

Keywords
outcome feedback, causal attributions, success expectancy, performance, persistence, motivational deficit

A holy grail for parents, teachers, coaches, and researchers in fields of education and psychology for many years has been the question, “What affects a child’s motivation to learn?” Numerous studies have highlighted the essential role of failure and fear of failure in achievement motivation, as these are elements that often lead to a loss of motivation (Molden & Dweck, 2006; Weiner, 1985). Motivated individuals typically believe that an outcome they are interested in can be successfully achieved (Bandura, 1997; Dweck & Leggett, 1988; Fong et al., 2019). Yet many parents, teachers, and coaches have been confronted with a child, who, following failure, will no longer strive to obtain better results. Some of these children may be suffering from learned helplessness (Maier & Seligman, 1976), in which they have developed, among other deficits, a belief that their actions have no effect on desired outcomes. People’s beliefs about the reasons for their successes and failures (i.e., their causal attributions) are particularly relevant in understanding learned helplessness, since low expectations of success are primarily a result of demotivating causal attributions about performance outcomes (Abramson et al., 1978; Chodkiewicz & Boyle, 2014; Dweck, 2002; Weiner, 1985). For instance, when an individual believes that a failure is due to a lack of ability or talent—a cause often perceived as personally uncontrollable and stable—the person is less likely to exert effort to improve at that task since a perceived lack of ability implies that exerting effort will make no difference to one’s outcomes on the task (Rascle et al., 2008). Thus, when a

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lack of ability is the perceived reason for a failure, the resulting low exertion of effort on that task (or avoiding the task altogether) in turn produces poorer achievement outcomes (Higgins & LaPointe, 2012; Hong et al., 1999; Marsh et al., 2016).

Learned helplessness was first demonstrated in experiments where dogs were repeatedly subjected to a mildly aversive stimulus that they could not escape, and when opportunities to escape were presented subsequent to the inescapable stimulus trials, most of the dogs took no action (Seligman & Maier, 1967). According to Abramson et al. (1978), during the repeated inescapable shock trials, the dogs had learned the lack of contingency between actions and outcomes, which produced a “giving up” reaction in a subsequent situation where shocks could be avoided. Applying this model to humans, it has been shown that an individual’s experiences with non-contingency between actions and outcomes may generate a perception of non-contingency, which in turn lead to the motivational and affective deficits characteristic of learned helplessness (Abramson et al., 1978; Dweck & Reppucci, 1973; Martinek, 1996; Seligman & Peterson, 1986). There is a difference between actual contingency or non-contingency and a perception of contingency or non-contingency. In learned helplessness experiments, a non-contingent outcome refers to the protocol put in place by the researchers in which outcomes for an individual are not affected by the individual’s behaviors but, rather, are determined by the researcher. In other words, non-accurate feedback is provided. For example, a researcher may provide repeated failure or success feedback, and this feedback does not correspond to actual outcomes obtained by a participant during the execution of a task. Tasks are used in which it is possible to provide accurate or non-accurate outcome information to participants. Where non-accurate feedback is provided, that feedback operationally defines the manipulation of uncontrollability of a participant’s outcomes, that is, the non-contingency between the person’s actions and outcomes. However, a perception of contingency or non-contingency refers to a participant’s subjective perception of contingency or non-contingency between their behaviors and outcomes—a perception usually measured with a self-report scale.

The reformulated learned helplessness model (Abramson et al., 1978), drawing upon attribution theory (Heider, 1958; Jones & Davis, 1965; Kelley, 1967), generated a large body of research demonstrating helplessness deficits linked to causal attributions, as well as research that refined the methods of measuring causal attributions about outcomes (Anderson & Deuser, 1991; Deuser & Anderson, 1995; Dweck & Reppucci, 1973; McAuley et al., 1992; Peterson & Seligman, 1984; Tennen & Eller, 1977; Weiner, 1985, 2018), and research that identified “helpless oriented” and “mastery oriented” patterns of cognitive, affective, and behavioral responses to achievement situations that are challenging (Cain & Dweck, 1995; Diener & Dweck, 1978, 1980; Dweck, 1975).

Because causal attributions vary on a number of dimensions, it took time for the research to delineate the causal dimensions that were most relevant to helplessness deficits (i.e., personal controllability and stability). Attribution research has repeatedly demonstrated that individuals who engage in attributional activity do so primarily to increase or maintain a sense of personal control (Weiner, 2018). In attribution theory, explaining a bad outcome with a personally controllable cause, such as a lack of effort, allows the individual to believe in the possibility of changing the outcome of a similar event in future (Weiner, 2010), a key feature of a mastery orientation to learning (Dweck & Leggett, 1988). In contrast, explaining a bad outcome with a personally uncontrollable cause, such as a lack of ability, reduces the individual’s expectation of future success with a similar event (Weiner, 2010), which is a common feature of a helpless orientation to learning (Molden & Dweck, 2006). Although a good deal of research has shown that repeated experience with actual non-contingency between actions and outcomes is the main determinant of helplessness deficits, other research has demonstrated that merely perceiving one’s outcomes to be due to personally uncontrollable causes (however induced) is a sufficient condition to produce helplessness deficits (Gernigon et al., 2000; Kofta & Sędek, 1989), as well as raise the risk of childhood depression (Kistner et al., 2001; Ziegert et al., 2001) and childhood anxiety disorders (Chorpita et al., 2016). Since children and their parents, teachers, coaches, and peers commonly communicate with each other using causal attributions about outcomes (Cimpian et al., 2007), it is not surprising that research has demonstrated those communications influence children’s perceptions of their outcomes, and may induce changes in the child’s perceptions that lead to a mastery or helpless orientation to learning (Goodvin & Rolfson, 2014; Vélez et al., 2015).

The academic context has resulted in a large amount of research on learned helplessness and associated motivational deficits, but less has been done in sports or physical education, with a few exceptions (Gernigon & Fleurance, 1998; Gernigon et al., 1999, 2000; Martinek, 1996; Martinek & Griffith, 1994; Portman, 1995; Walling & Martinek, 1995)—despite the longstanding recommendations of some researchers (e.g., Biddle, 1993). Yet helplessness deficits seem especially applicable in such contexts, given that public demonstration of motor skills fosters social comparisons which may influence the use of maladaptive learning strategies, such as, for example, masking poor skills and low competence by labeling new tasks as “boring” and withdrawing effort after failure in order to avoid humiliation or maintain respect (Portman, 1995), a pattern consistent with helpless oriented learning (Dweck et al., 1995). Furthermore, the majority of helplessness research in such contexts has been conducted with elementary, high school, or college-age youth, with limited research during adolescent middle-school years, despite the finding that the debilitating effects of helplessness deficits affect middle-school students more
than elementary school students (Martinek & Griffith, 1994). By the time students reach middle-school, those with helplessness deficits are already attributing failures to low ability, holding low expectations for future success after failure, and giving up quickly in the face of their failures (Hokoda & Fincham, 1995; Martinek & Griffith, 1994; Mezzulis et al., 2011; Seligman & Peterson, 1986; Walling & Martinek, 1995; Weidinger et al., 2019). Research on the early development of helplessness deficits in kindergarten children (Burhans & Dweck, 1995; Cain & Dweck, 1995; Kistner et al., 2001; Upadyaya & Eccles, 2014; Ziegert et al., 2001) has provided a basis for developing age-appropriate interventions to counteract the effects of helplessness deficits (Blackwell et al., 2007; Craske, 1985; Craven et al., 1991; Lazowski & Hulleman, 2016; Moorman & Pomerantz, 2010).

Similar research, such as studies of the effects of accurate (contingent) and inaccurate (non-contingent) feedback on middle-schoolers approaches to challenging tasks will be necessary for designing and testing interventions for middle-school age groups (Blackwell et al., 2007; Boese et al., 2013; Li & Bates, 2019). Gernigon and colleagues suggested using the well-established learned helplessness triadic design (Seligman & Maier, 1967) in which feedback about performance outcomes is either accurate and contingent, or non-contingent (usually yoked) feedback, and where a control (no feedback) condition is also included. Using this triadic design to investigate helplessness deficits in a motor task, the findings have provided some insight into the effects of outcomes perceived as non-contingent (Gernigon & Fleurance, 1998; Gernigon et al., 1999, 2000). For instance, Gernigon et al. (2000) had participants perform in a task of pistol shooting at a mobile target presented on a computer screen. The results revealed worse performance by participants who experienced prior non-contingent outcome feedback in the task, compared to those who experienced prior accurate and contingent feedback about their outcomes. There were no differences between the experimental conditions (contingent vs. non-contingent) on the measured attributional dimensions (or on self-efficacy expectations) in that study. However, Gernigon et al. (2000) did not measure the two most important attributional dimensions (i.e., perceived personal control and stability) that affect expectations and behaviors, despite the large body of research (but none using a triadic learned helplessness design) demonstrating that failures perceived to be due to personally uncontrollable and stable causes generate lower success expectancy and poorer performance in adults (Coffee & Rees, 2008, 2011; Higgins & LaPointe, 2012; Le Foll et al., 2006; Rascle et al., 2008).

Hypotheses

Thus, the purpose of the present study was to use a triadic learned helplessness design to investigate the effects of accurate and contingent outcome feedback versus non-contingent outcome feedback on middle-school students’ causal attributions (i.e., perceived personal control and stability), success expectancy, performance, and persistence behavior. The study focused on initial effects (Hypothesis 1) and residual effects (Hypothesis 2) of exposure to contingent and non-contingent feedback in a motor task. The initial effects hypothesis (Hypothesis 1) addressed the question of whether contingent and non-contingent outcome feedback during a motor task would differentially affect causal attributions and success expectancy. It was predicted that, compared to those receiving accurate contingent feedback about outcomes, the group receiving non-contingent feedback during an initial motor task would produce more personally uncontrollable and stable attributions about that initial task, and have lower success expectancy.

The residual effects hypothesis (Hypothesis 2) addressed the question of whether contingent and non-contingent outcome feedback during an initial motor task would differentially affect causal attributions, success expectancy, and performance on a subsequent motor task, as well as persistence during a subsequent opportunity to practice the motor task. It was expected that non-contingent feedback about outcomes during an initial task would lead to more personally uncontrollable and stable attributions, lower success expectancy strength, and lower levels of performance on the subsequent task, as well as lower persistence on a free attempt at the task when compared to a contingent feedback group and a control group (who have no exposure to the contingency manipulation).

Method

Participants

Forty-six middle school male students (aged 13–16, M = 14.3 years; SD = 1.6) from physical education classes in three different French schools provided informed consent to participate in the study. Power analysis using G*Power 3.1 (Faul et al., 2007, 2014) indicated that based on an estimated effect size ($\eta^2 = 0.17$) from attribution, success expectancy, performance, and persistence measures in previous research (Rascle et al., 2008), 16 participants per group were considered sufficient to achieve a power of 0.9 in an F-test, at an $\alpha = 0.05$. Since practical limitations often accompany field research in schools, we aimed for a minimum sample size of 48 students for the field experiment so that the cell size in each condition would be approximately 16 participants.

Design

Each school’s physical education class was randomly assigned to one of three conditions, as follows: Non-contingent group (16 participants), Contingent group (18 participants), Control group (12 participants). Given the difficulties of conducting experimental studies in school settings (e.g., timing allowed
by a school for the research, the physical structure of different school gymnasia, and the restrictions on class time), this field study used random assignment of physical education classes to conditions of the experiment, rather than random assignment of students to conditions. Although it is possible, but unlikely, that students in the same class might share similar perceptions of learning and motivation which could affect the results of the study, the random assignment of classes ensured that it would be additionally unlikely that a class with particularly low or particularly high perceptions of learning/motivation would be assigned to the non-contingent and contingent feedback groups, respectively.

One week before the beginning of the experiment, in order to assess participants’ perceived ability level in badminton, each participant responded to a single item (“In badminton, my level of ability is . . .”) on a Likert scale ranging from (1) very unsatisfactory to (7) very satisfactory. One week later, the random assignment of classes to the conditions occurred and the experimental testing began. To ensure the equivalency of the groups, (a) students in each PE class were all male, (b) there were no differences in the mean age of students between the conditions (Non contingent group: mean age = 14.4, SD = 1.21; Contingent group: mean age = 14.6, SD = 1.49; and Control group: mean age = 14.5, SD = 1.50); (c) all students had at least one badminton experience in their physical education curriculum before the experiment, ensuring that they had the resources to complete the required task; and (d) there was no difference in students’ mean perceived badminton ability (see Table 1) between the experimental conditions, $F(2, 45) = 0.333, \eta_p^2 = .015, p = .718$.

### Procedure

The experiment was introduced by the students’ physical education teacher and a visiting researcher during a regular class. The researcher explained the task as a test of badminton ability being undertaken in several schools. The testing consisted of a badminton task (described below) and took place in the gymnasium but out of sight of the class, so that the teacher and classmates were able to continue with their class and were not able to observe a participant during the task. Students came to the testing area one at a time to be tested individually, and then returned to their class.

The experimental procedure consisted of four phases: familiarization, treatment, test, and debriefing (Gernigon et al., 2000).

#### Familiarization

During the familiarization phase, participants in the experimental groups were given an explanation of the required task. They were shown how to shoot an underarm serve in badminton in order to reach the opposite service square in the opposing half-court.

#### Treatment phase

The experimenter told each participant in the two experimental conditions that the first trial would be made up of 30 underarm serves to a target in the opposite
court service square. Failure performance was induced through the use of a small target (30×30 cm) added on the ground in the opposing service square at which the participant was told to aim. Before the participants stroked their first serve, a computer emitting an auditory signal every 5 seconds was started and participants were told that if they did not make a serve during the quiet 5 seconds, it would constitute a missed try. Finally, each participant was informed that a missed service (the birdie does not pass the net) would not be counted. The reason for not counting missed tries for individuals in the Contingent condition was because feedback in the Non-contingent group was yoked to that of the Contingent group, and Contingent group feedback was only given if the birdie passed the net.

For the Contingent group, the experimenter first presented the study, individually, and as follows: “this task identifies pupils capable of serving and reaching a predefined target.” Although participants were able to observe in situ their performance, the experimenter also provided oral feedback such as “you got that one” (success) or “you did not get that one” (failure) after each trial. For the Non-contingent group, the experimenter first presented the study, individually, and as follows: “this task identifies pupils capable of spatially representing an area to be reached and of relating this spatial representation and it’s motor skills during a service.” A diagram accompanied this explanation, and was visible and pointed to on a board, so that the student could see/locate the area to be reached by their serves. A sheet covered the net so students could not see the target, and the oral feedback provided by the experimenter after each try was yoked to the oral feedback given to each member of the Contingent group. For both feedback groups, most of the oral feedback was failure feedback given the difficulty of the task. At the end of the treatment phase for the feedback groups, the experimenter told each participant his score (Non-contingent participants received a yoked total score) and asked the participant to write down a likely cause of his performance, a participant then rates the cause on 12 rating scales designed to measure four dimensions of causal attributions, namely, Locus of causality (three items), Personal Control and Stability (three items), External Control (three items), on 9-point Likert-type scales, from 1 (external, uncontrollable, or stable) to 9 (internal, controllable, or unstable). In the present study, only the Personal Control and Stability dimensions were retained for the statistical analyses. For the Personal Control scale on the EMAC, higher scores represent a perception of greater personal control over the cause of an outcome, and higher scores on the Stability scale represent a perception of a more temporary cause (i.e., the cause is viewed as more unstable). In the present study, reliability coefficients (α’s) were .82 and .81 for the EMAC Personal Control and Stability scales, respectively.

To occupy the Control group students for an equivalent amount of time as the initial (treatment) task took for the other two groups, each of the Control group students performed a simple task—throwing a badminton birdie (30 tries) over a badminton net, without a target to be reached, with no indication (visual or oral) of “success” or “failure,” and with no score provided. The experimenter first presented the study, individually, and as follows: “this task identifies pupils capable of serving and reaching the opposing ground.” The Control group students were able to see where the birdie landed as there was no sheet covering the net. The Control group participants were not given a performance score and did not complete any questionnaires in this phase.

**Test phase.** During the Test Phase, participants in each of the three groups were given the same task that was experienced by the Non-contingent group during the treatment phase (underarm serves, with the sheet covering the net). In all the groups, participants received the same information as that delivered to the Non-contingent group during the Treatment phase and the board/diagram was also present. Each participant received contingent feedback after each of 20 obligatory serves. After the 20 obligatory serves, each participant was then free to continue or not for 10 additional serves without feedback. At the end of the Test Phase, the participants completed the causal attribution and success expectancy questionnaires.

**Debriefing.** Finally, at the end of the experiment, each participant was individually debriefed about the real purpose of the study. Non-contingent group participants were particularly encouraged to attribute their failure to the experimental design and not to their lack of competence.

**Measures**

**Causal attributions.** The Échelle de Mesure des Attributions Causes (EMAC; Fontayne et al., 2003) was used to evaluate attributions about performance. The EMAC is the validated French version of the Causal Dimension Scale 2 (CDS 2; McAuley et al., 1992), and its full description, use, and scoring are described elsewhere (Le Foll et al., 2006). After writing down a likely cause of his performance, a participant then rates the cause on 12 rating scales designed to measure four dimensions of causal attributions, namely, Locus of causality (three items), Personal Control (three items), Stability (three items), and External Control (three items), on 9-point Likert-type scales, from 1 (external, uncontrollable, or stable) to 9 (internal, controllable, or unstable). In the present study, only the Personal Control and Stability dimensions were retained for the statistical analyses. For the Personal Control scale on the EMAC, higher scores represent a perception of greater personal control over the cause of an outcome, and higher scores on the Stability scale represent a perception of a more temporary cause (i.e., the cause is viewed as more unstable). In the present study, reliability coefficients (α’s) were .82 and .81 for the EMAC Personal Control and Stability scales, respectively.

**Success expectancy strength.** A five-item instrument (Bandura & Adams, 1977) was used to assess the strength of participants’ success expectancy. After participants completed the task, they were provided a questionnaire that asked them to answer a generic statement: “In this badminton task, I expect that I will be able to obtain the following results on the next try . . .,” after which five statements are provided indicating different scores (arranged from lowest to highest scores, 3 out of 30; 9 out of 30; 15 out of 30; 21 out of 30, 27 out of 30). For each of the five different possible scores, participants
ticked either a “yes” or a “no,” and for each “yes,” they indicated their degree of confidence toward obtaining the designated score using a scale ranging from 10% (not sure at all) to 100% (totally sure). The success expectancy strength score is the average percentage for “yes” answers (i.e., the sum of “yes” percentages divided by five (i.e., the number of statements)); thus, low and high scores represented low and high success expectancy strength, respectively.

**Performance.** The task involved underarm badminton serves on a badminton court. Performance was scored as the percentage of successful underarm serves, with scores ranging from 0 (none) to 100 (maximum number of successful serves). The percentage measure was chosen because of the difference in serves between performance 1 (30 obligatory serves) and performance 2 (20 obligatory serves), described in the Procedure section above.

**Persistence.** Persistence was assessed, for each participant, by adding the number of times a participant engaged in a new try after the obligatory 20 services in the test phase (described below). Persistence scores ranged from 0 (no tries) to 10 (maximum number of tries).

**Data analysis**

All data are reported as means and standard deviations (SD). A mixed 2 × 2 MANOVA with Group (non-contingent, contingent) as a between-subjects factor and Experiment Phase (treatment, test) as a within-subjects factor, was used to examine the impact of the contingency manipulation on repeated measures variables (Personal Control and Stability causal attributions, success expectancy strength, and performance). Significant multivariate effects were followed up with univariate ANOVAs on the dependent variables.

In addition, test phase dependent variables (Personal Control and Stability causal attributions, success expectancy strength, performance, and persistence) were examined using univariate ANOVA with Group (non-contingent, contingent, control) as a between-subjects factor.

To examine differences in perceived failure and perceived contingency following the treatment phase between the Non-contingent and Contingent groups (manipulation checks), t-tests were used. To further explore the effectiveness of the contingency manipulation, a regression analysis was conducted to examine experimental condition (Non-contingent, Contingent), perceived failure, and performance 1 scores as predictors of perceived contingency in the treatment task situation.

Measures of effect size (partial eta-squared ($\eta^2_p$)) for univariate analyses, and Cohen’s $d$ for $t$-tests are reported for all significant effects. Significance was set at 0.05 (two-tailed) for all analyses, unless otherwise stated, and corrected for multiple comparisons where necessary. Based on criteria outlined by Bakeman (2005), $\eta^2_p$ values of .02, .13, and .26, and Cohen’s $d$ values of .20, .50, and .80 were taken as corresponding to small, medium, and large effect sizes, respectively. Data analysis was conducted using the Statistical Package for the Social Sciences, version 24 (SPSS Inc., Chicago, IL, USA).

**Results**

**Manipulation Checks**

**Perceived failure.** At the end of treatment phase, subjects were asked to indicate their perception of failure (“I feel that I have just failed completely”) by marking a line across a 20 centimeter line between two extremes anchored at either end by “totally disagree” to “strongly agree.” Thus, perceived failure scores range from 0 - 20 with higher scores representing greater perceived failure. There was no significant difference in perceived failure between the Non-contingent ($M=14.04, SD=3.48$) and Contingent ($M=13.61, SD=5.45$) groups, $t(29.24)=.276, d=0.09, p=0.78$. Students in both experimental groups considered their performance in the treatment phase as relatively poor.

**Perceived contingency.** At the end of treatment phase, subjects were also asked to indicate their perception of contingency (“I feel that, whatever I do in this task, I am not able to control what happens”) by marking a line across a 20-cm line between two extremes anchored at either end by “Strongly Agree” to “Strongly Disagree.” Thus, for the perceived contingency measure, lower scores represent a perception of lower contingency between one’s actions and one’s outcomes. Consistent with the experimental manipulation, the treatment phase was perceived as lower in contingency by the Non-contingent group ($M=8.00, SD=3.33$) than the Contingent group ($M=12.47, SD=3.35$), $t(32)=3.89, d=1.33, p=.000$. Also, regression analysis indicated that the experimental condition (Contingent vs. Non-contingent) predicted perceived contingency of the treatment task situation ($b=.567, p=.000$), but not perceived failure ($b=.048, p=.790$), or performance score in the treatment phase ($b=.198, p=.263$), indicating that it was the feedback provided (Contingent vs. Non-contingent) that “created” the perception of low contingency, not the participant’s perception of failure or their performance score in the treatment phase.

**Experimental Variables**

Means and standard deviations for each dependent measure in the treatment and test phases of the experiment are shown in Table 1. The $2 \times 2$ MANOVA revealed multivariate effects for Group, $F(4, 29)=11.87, \eta^2_p=.621, p=.000$, for Experiment Phase, $F(4, 29)=6.89, \eta^2_p=.488, p=.000$, and for the interaction of Group and Experiment Phase, $F(4, 29)=5.56, \eta^2_p=.434, p=.002$. 


Causal Attributions

Personal control. For the Personal Control measure, there were significant univariate effects of Group, \( F(1, 32) = 17.31, \eta^2_p = .351, p = .000 \) and Experiment Phase, \( F(1, 32) = 6.42, \eta^2_p = .167, p = .016 \), but no interaction between Group and Experiment Phase, \( F(1, 32) = .002, \eta^2_p = .00, p = .968 \). The main effect for Experiment Phase indicated Personal Control scores were better overall in the treatment phase (\( M = 5.71, SD = 2.19 \)) than in the test phase of the experiment (\( M = 4.75, SD = 1.99 \)), thus there was an overall reduction in perceived personal control during the experiment. The significant Group main effect indicated that participants in the Contingent group (\( M = 6.21, SD = 1.90 \)) attributed their performance more to controllable causes than did the Non-contingent group (\( M = 4.11, SD = 1.67 \)). This difference was significant both in the treatment phase, \( t(32) = 3.18, d = 1.09, p = .003 \), which supports Hypothesis 1 (initial effect), and in the test phase, \( t(27.35) = 3.56, d = 1.22, p = .001 \), which supports Hypothesis 2 (residual effect).

In the test phase, participants in the Control group (\( M = 5.08, SD = 1.92 \)) attributed their performance more to controllable causes than did the Non-contingent group (\( M = 3.64, SD = 1.17 \)), \( t(26) = 2.44, d = .93, p = .022 \), which also supports Hypothesis 2 (residual effect). Examination of test phase Personal Control means in the Contingent group (\( M = 5.73, SD = 2.07 \)) and Control groups showed they did not differ, \( t(28) = .872, d = .32, p = .393 \).

Stability. For the Stability measure, there was no significant univariate effect of Group, \( F(1, 32) = .044, p = .835, \eta^2_p = .001 \), or Experiment Phase, \( F(1, 32) = 2.18, p = .149, \eta^2_p = .064 \), and no interaction between Group and Experiment Phase, \( F(1, 32) = .010, p = .921 \). As shown in the Table, stability scores in the Contingent and Non-contingent groups were quite similar throughout the experiment. This lack of difference was true in the treatment phase, \( t(32) = .284, d = .09, p = .778 \), which is not consistent with Hypothesis 1 (initial effect), and in the test phase, \( t(32) = .129, d = .04, p = .899 \), which is also not consistent with Hypothesis 2 (residual effect).

In the test phase, the lack of a difference in Stability attributions between the Control (\( M = 4.24, SD = 2.28 \)) and Non-contingent (\( M = 3.83, SD = 1.63 \)) groups was not consistent with Hypothesis 2 (residual effect), \( t(26) = .551, d = .21, p = .586 \). Lastly, test phase Stability means in the Contingent (\( M = 3.76, SD = 1.70 \)) and Control groups did not differ, \( t(28) = .661, d = .24, p = .514 \).

Success expectancy strength. For the Success Expectancy Strength measure, there was a significant univariate effect of Group, \( F(1, 32) = 6.94, \eta^2_p = .178, p = .013 \), but no effect of Experiment Phase, \( F(1, 32) = 1.69, \eta^2_p = .050, p = .202 \), and no interaction between Group and Experiment Phase, \( F(1, 32) = 1.19, \eta^2_p = .004, p = .733 \). Participants in the Contingent group (\( M = 36.00, SD = 17.16 \)) reported greater success expectancy strength than did the Non-contingent group (\( M = 22.48, SD = 13.66 \)). This group difference was significant both in the treatment phase, \( t(32) = 2.25, d = .78, p = .031 \), which supports Hypothesis 1 (initial effect), and in the test phase, \( t(32) = 2.81, d = .97, p = .008 \), which supports Hypothesis 2 (residual effect).

In the test phase, participants in the Control group (\( M = 30.45, SD = 17.37 \)) had greater success expectancy strength than the Non-contingent group (\( M = 21.15, SD = 12.36 \)), \( t(26) = 1.65, d = .62, p = .054 \) (one-tailed), which also supports Hypothesis 2 (residual effect). Test phase success expectancy strength did not differ for the Contingent (\( M = 35.22, SD = 16.22 \)) and Control groups, \( t(28) = .768, d = .28, p = .449 \).

Performance and persistence

Performance. For the Performance measure, there was a significant univariate effect of Group, \( F(1, 32) = 10.04, \eta^2_p = .239, p = .003 \), of Experiment Phase, \( F(1, 32) = 17.98, \eta^2_p = .360, p = .000 \), and a significant interaction of Group and Experiment Phase, \( F(1, 32) = 19.35, \eta^2_p = .377, p = .000 \). The Experiment Phase main effect indicated that performance scores were worse in the treatment phase (\( M = 20.72, SD = 3.70 \)) than in the test phase of the experiment (\( M = 26.32, SD = 6.86 \)), thus there was an overall improvement of performance during the experiment. The Group main effect indicated the Contingent group (\( M = 25.69, SD = 5.03 \)) performed better overall than the Non-contingent group (\( M = 21.35, SD = 5.54 \), but the Group × Experiment Phase interaction indicated the group difference was only significant in the test phase (Hypothesis 2), \( t(32) = 4.28, d = 1.47, p < .001 \), and not in the treatment phase, \( t(32) = 1.13, d = .39, p = .265 \). As shown in Figure 1, each group’s mean performance in the initial (treatment) task was comparable, and only the Contingent feedback group showed improved performance from treatment to test phase.

In the test phase, participants in the Control group (\( M = 30.90, SD = 10.68 \)) performed better than the Non-contingent group (\( M = 21.15, SD = 6.70 \)), \( t(25) = 2.89, d = 1.13, p = .007 \), which also supports Hypothesis 2 (residual effect). Examination of test phase performance means in the Contingent (\( M = 35.22, SD = 16.22 \)) and Control groups showed they did not differ, \( t(27) = .146, d = .06, p = .884 \).

Persistence. For the Persistence measure in the test phase, there was a significant univariate effect Group, \( F(2, 45) = 21.34, \eta^2_p = .498, p = .000 \). In the free period of the test phase, participants in the Contingent group (\( M = 9.61, SD = 1.42 \)) practiced their serve more often than the Non-contingent group (\( M = 4.50, SD = 3.96 \)), \( t(18.4) = 4.88, d = 1.76, p < .001 \). Similarly, in the free period those in the Control group (\( M = 9.67, SD = 0.77 \)) practiced their serve more often than the Non-contingent group, \( t(16.52) = 5.08, d = 1.69, p < .001 \). Both findings support Hypothesis 2 (residual effect). Examination of persistence means in the Contingent
and Control groups showed they did not differ, $t(28) = .123$, $d = .05$, $p = .903$.

**Discussion**

The objective of the present study was to investigate the effect of experiencing contingent (accurate) or non-contingent feedback about outcomes on middle-school students’ causal attributions, success expectancy, performance, and persistence in a motor task.

Despite the high rate of failure in a motor task for both the Contingent and Non-contingent feedback groups in the treatment phase, the Contingent group—getting accurate feedback about performance—had a higher sense of personal control and expectancy of success than the Non-contingent feedback group in the treatment phase, and were able to maintain the higher sense of personal control, higher success expectancy, and show better performance and higher levels of persistence (practice behavior) than the Non-contingent feedback group in the subsequent test phase of the experiment.

The initial effects hypothesis (*Hypothesis 1*) was confirmed for perceived personal control and success expectancy strength, but not for the perceived stability measure. Compared to the Contingent feedback group, non-contingent feedback about outcomes during the initial motor task (treatment phase) produced more personally uncontrollable attributions about the initial task, and lower success expectancy strength. In addition, there was no significant difference in perceived failure or performance scores between the Contingent and Non-contingent groups in the treatment phase. Thus, given that the experimental condition (Contingent vs. Non-contingent feedback) predicted perceived contingency of the treatment task situation, but perceived failure and performance did not, it can be assumed that only the non-contingent/contingent manipulation affected the perceived personal control attributions in the treatment phase.

The residual effects hypothesis (*Hypothesis 2*) was confirmed for the perceived personal control, success expectancy, performance, and persistence measures, but not for the perceived stability measure. Compared to the Contingent group and the Control group, non-contingent feedback about outcome during the treatment phase (initial task) led to more personally uncontrollable attributions, lower success expectancy, and lower levels of performance in the test phase, as well as lower persistence on a free attempt at the task. Contingent group and Control group attributions, success
expectancy, performance, and persistence showed no differences, as predicted.

The lower performance and persistence levels of the Non-contingent group compared to the Contingent and Control groups in the test phase appear to be residual effects of initial (non-) contingent outcome feedback on causal attributions and success expectancy. In the treatment phase, participants in the Non-contingent group perceived the cause of their performance as more personally uncontrollable and reported lower success expectancy than those in the Contingent group; in the test phase they also viewed their performance as more personally uncontrollable and reported lower success expectancy, compared to those in the Contingent and Control groups, which suggests the perception of uncontrollability and weaker success expectancy induced by non-contingent feedback about outcomes during the treatment phase endured through the test phase when individuals in the Non-contingent group were no longer blocked from viewing the results of their service tries. These findings are consistent with previous findings demonstrating that causal attributions of personal uncontrollability contribute to both motivational and performance deficits (Abramson et al., 1978; Blackwell et al., 2007; Boese et al., 2013; Gernigon & Fleurance, 1998; Weiner, 2010).

The findings that participants in the Non-contingent group performed less well and persisted less than those in the Contingent and Control groups are consistent with other research that showed accurate contingent feedback about outcomes leads to better levels of practice and performance than non-contingent feedback about outcomes (Gernigon et al., 1999, 2000). Furthermore, the present findings indicate that only the performance of those in the Contingent group increased significantly between the treatment and the test phase. During the treatment phase, both groups had the opportunity to make 30 obligatory service tries—in effect, both groups were practicing their service stroke—but the Non-contingent participants could not see the opposite court or target and were receiving inaccurate non-contingent feedback; only the Contingent group were able to observe the results of each of their service tries, which were tied to the accurate contingent feedback. Later, in the test phase, both the Contingent group and the Control group performed better and persisted more than the Non-contingent group. In other words, not being able to see the results of each service try in the initial task was an important variable affecting the performance and persistence levels of the Non-contingent group in the later test phase where they again could not see the results of each service try, which suggests that the Non-contingent group were experiencing a helplessness deficit in the test phase of the experiment. Thus, visual linking of actions and outcomes in the motor task appears to be key to the present findings. The Non-contingent group received the same proportion of positive and negative oral feedback from the tester as that received by Contingent group in the treatment phase. But despite receiving the same oral feedback, it was not possible for Non-contingent members to see each serve’s outcome and make corrections. Without the visual feedback to link actions and outcomes, students in the Non-contingent group were experiencing personally uncontrollable outcomes—some successful, but mostly failures—and an immediate effect was produced on their personal control and success expectancy perceptions as well as a residual effect on their later test performance, personal control and success expectancy perceptions, and willingness to practice their serve. It appears that during the treatment phase, the Non-contingent group members may have lost confidence in their ability to perform. Confidence in one’s abilities grows with finding ways to improve one’s performance. The Non-contingent group were experiencing lots of failures they learned about through the oral feedback from the tester, but they could not see why. Without being able to correct for errors/fails on each serve, the Non-contingent members were unable to find ways to compensate when things were not working out well, and the possible loss of confidence in ability carried over to the next round of the task and essentially shut down a willingness to practice when free to do so.

In a future study, additional practice sessions or additional maximum numbers of practice serves might be varied (as experimental variables) to assess non-attempted tries during the test phase in greater detail. It should be noted that, in the present study, 4 of the 16 pupils (25%) in the Non-contingent group did not make any practice serves, whereas pupils in the Contingent and Control groups all made practice serves (the number of practice serves ranged from 4 to 10 in the Contingent group, from 8 to 10 in the Control group, and from 0 to 10 in the Non-contingent group). Non-attempts in practice sessions would provide a measure of “passivity” that indicates the helpless behavior of an individual who voluntarily gives up one (or more) try(ies). To our knowledge, to date, no study dealing with helpless oriented learning in physical education classes has examined non-attempts in open/free practice sessions.

**Limitations and Implications**

While the data from the present study were collected within physical education classes, the task was not part of the class and thus it could be argued that the experiment lacked ecological validity. Future studies should address whether the present study findings can be generalized to real physical education settings. In addition, the present findings are limited to middle school boys, as the study sought to maintain the equivalency of experimental groups by sex. The selection of males in the present study was due in part to the mixed research findings in terms of sex-related learned helplessness effects. For example, in animals, Dalla et al. (2008) observed that only male rats expressed learned helplessness, not female rats. In contrast, with humans, in a school context, some studies have shown that girls were more prone to learned helplessness than boys (Dweck & Bush, 1976; Dweck et al., 1978, 1980; Parsons et al., 1982), but the measures were only on attributions for failure, and those studies
did not use the well-established learned helplessness triadic design. In a sport context, only one study investigated sex differences in learned helplessness and did not show differences between males and females in tennis (Prapavessis & Carron, 1988), and once again not using a triadic design. More practically, in the present study, given the schools’ limitations on testing time for the study, the researchers could intervene in only one physical education session for each class, which made it impossible for all the students in that grade level to complete the experiment. Therefore, in addition to considerations of mixed evidence of learned helplessness sex differences, the decision for the present research was to retain boys rather than girls on the basis of studies showing a greater interest in PE/sport at this age among boys compared to girls (Deaner et al., 2016). Future research will be needed to determine whether the present findings would be similar or not with samples of female middle school students in a sport context.

Another limitation of the present study is the impossibility of distinguishing between the potential effects of non-contingent success (positive) and failure (negative) feedback. In the present study, mean performance scores during the treatment phase, $M_{\text{Contingent}}=6$ and $M_{\text{Non-contingent}}=6.44$, indicates that about 80% of the delivered feedback was failure feedback and 20% was success feedback. If one can assume that only 20% successful tries is an objective failure performance, the perceived failure measure indicated an even lower subjective failure view ($M_{\text{Contingent}}=13.61$ vs. $M_{\text{Non-contingent}}=14.04$). Future research might compare the effects of positive and negative contingent/non-contingent feedback about performance in a similar triadic design where the preponderance of performance outcomes are either successes (positive feedback) or failures (negative feedback). This would allow a comparison of non-contingent feedback and contingent feedback effects for the two types of performance outcomes, and would also allow the possibility of distinguishing between the effects of positive and negative non-contingent feedback. For example, it is possible that non-contingent success feedback on performance produces fewer cognitive and behavioral deficits than does non-contingent negative feedback (Seligman et al., 1990).

The main results indicate that non-contingent feedback delivered after an initial single task appears to induce helplessness deficits in performance and persistence on a subsequent task. Since parents, teachers, and coaches are often faced with delivering feedback following disappointment or failure, it is important to understand what factors foster a renewed desire to persist despite the setback, and those that do not. The clear implication that is supported by the results of the present study is the importance of providing feedback that is contingent on achieved performance, whether it is positive (success) or negative (failure) feedback. When the feedback is accurate (contingent on performance), performance tends to be viewed as more personally controllable, thus positively influencing success expectancies, subsequent performance, and a willingness to continue to try to do better. However, when feedback is not contingent on performance, performance tends to be viewed as less personally controllable, which reduces expectancy about future success, that, in turn, affects future performance levels and reduces the willingness to continue to try to do better.

Authors’ Note
This manuscript has not been published elsewhere and is not being reviewed for publication by any other journal.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding
The author(s) received no financial support for the research, authorship, and/or publication of this article.

Ethics Statement
The research reported in this manuscript was completed in full compliance with APA ethical standards (University of Rennes committee approval number: 755). All participants in the experiment provided informed consent and were fully debriefed at the end of the study.

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