

Perceived Competence and Skill Development in Physical Education: The Effect of Teacher Feedback

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Abstract: This study examined the effects of feedback on perceived competence and student performance in physical education. The sample ($N = 113$) consisted of fifth-grade physical education students, recruited from two elementary schools and randomly assigned into small groups. Participants within each group were randomly assigned to receive positive general, corrective informational, or no feedback and completed pre- and post-task questionnaires. Groups were given a lacrosse shot task presentation and then completed a lacrosse shot pre-test, practice session, and post-test, including a pre- and post-test. During the lacrosse task, teachers administered feedback treatments to participants at the rate of every other attempt for a total of six feedback statements, excluding the control group. Lacrosse experience was found to be 2.45 on a 9-point Likert-type scale, demonstrating that the sample was unfamiliar with the lacrosse skill. Three separate split plot 2×3 analysis of variance (ANOVA) tests with repeated measures were conducted to determine whether feedback treatment type influenced participants' perceived competence, product performance skill, and process performance skill when considering pre- and post-task measures. The findings demonstrated that feedback appears to have a limited effect on perceived competence and performance during unfamiliar tasks in elementary school physical education.

Key words: Physical education, motivation, feedback, perceived competence, skill performance.

1. Introduction

Participating in physical activities within diverse settings (i.e., sport, physical education) can support health and personal enjoyment for all individuals. Youth who have positive and enjoyable physical activity experiences are more likely to be motivated toward being physically active [1, 2]. Adults such as parents, coaches, and teachers support children's physical activity behaviors through their role as significant others. Significant others have the power to cultivate, develop, and/or advance the natural motivation a child possesses to increase the likelihood that they maintain physical activity behaviors during adolescence and adulthood [3]. Physical education teachers support children's physical activity via delivery of learning tasks and support for student performance. The aim of the present study was to

examine the effect of manipulated feedback, as a delivery behavior, on students' perceived competence and performance in physical education settings.

According to Self-Determination Theory (SDT) [3], children have a natural tendency to seek challenges and new experiences that provide them with opportunities to master certain actions and behaviors. These postulations hold true for tasks in physical activity contexts such as those related to the development of motor and sport skills. Accordingly, children who are motivated to participate in physical activity, or any other action, will exert further effort and seek out challenges that will result in competent performance. Intrinsic motivation is the preferred motivational orientation for children and leads to a greater likelihood of continued effort and challenge-seeking behaviors [3]. Intrinsic motivation in children refers to the participation and engagement in an action or behavior for pleasure, interest, and satisfaction, rather than simply for external rewards [3]. Deci and Ryan [3] posit that perceived competence lies at the core of

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intrinsic motivation. Perceived competence, they state, is both intrinsically rewarding during participation and influences subsequent intrinsic interest. This construct has been found by some researchers to be the most significant mediator of intrinsic motivational orientations [4, 5].

Deci and Ryan [3] theorized that social agents impact children's self-perceptions (e.g., perceived competence). As significant others, adults and peers influence self-perceptions by responding directly to mastery attempts made by students. Feedback, modeling, and reinforcement are types of responses that the students receive. Children who receive feedback after mastery attempts that is directed at both skill improvement and enjoyment will likely develop an intrinsic motivational orientation toward future mastery attempts [6]. Competence Motivation Theory is a theoretical framework that explains the relationships between significant others, specifically feedback, and motivational processes [7]. When children perceive they lack confidence or have low perceptions of competence, they will cease to seek future mastery attempts. Harter [8, 9] suggested that social regard and perceived competence, when combined, affect motivation which in turn impacts performance.

Many physical educators choose to define student performance based on the outcomes of skill practice. This type of learning assessment is also known as the product of the performance because the score conceivably informs the teacher and the student how well the student performs the skill [10]. Alternately, teachers may adopt a process performance assessment format to determine how well students are learning skills [10]. A student who performs well in relation to the product may have more immediate success in sport but may lack in correct form for future improvement [10]. Conversely, a lack of appropriate process performance (e.g., mastered skill form) may not lead to immediate success but will likely positively influence performance in the future. Those students who perform

well in the process assessment may not execute skill well enough to be successful in a sport, but they will have formed the basis for future improvement because they have proper technique. Ames [11] suggests that when student performance evaluation is based on improvement, meeting goals, and effort, positive affect is supported and motivation persists. If students do not feel happy, confident, and successful, they may abandon the sport or associated tasks for something else, possibly unrelated to physical activity, that will provide them with these feelings.

Students can achieve positive feelings before, during, and after process and product performance, tasks, and activities. Nicaise et al. [12] suggest students who gain positive attitudes toward what they are learning in physical education are more likely to engage in physical activity outside of the school day. Other studies have led researchers to report similar findings related to the importance of positive attitudes towards physical education. Perceived competence has been identified as a psychological construct that plays a crucial role in student motivation [3], specifically in physical education settings [5, 13, 14].

In the physical education context, one teacher behavior that has been hypothesized to impact student motivation is feedback [3, 5]. Verbal feedback is defined as anything a teacher says that provides students with some type of information [15]. General feedback statements may refer to a student performance [16], or they may be made in reference to effort [17]. Fredenburg et al. [18] reported general feedback to play a role in developing and sustaining self-perceptions, especially in skills that are unfamiliar. Few studies have explored the effects of general feedback in physical education. Of those completed studies, unexpected results were reported. Ryan [19] warned that future studies on general feedback, specifically positive general feedback, should be carefully planned so the feedback does not have a controlling effect on student motivation.

Feedback can also be informational when statements

are directed to students with intent to inform them of something particular about their performance. The statement can be made with an intention to alter the performance based upon teacher expectations [20], or inform students of the performance quality [21]. Feedback has been hypothesized to not only impact motivation [18, 22] but also student achievement [10, 18]. Learning, achieving, and improving performance have been found to predict motivation and associated constructs [5].

Feedback that provides students with specific information may be beneficial for student achievement [10, 23, 24]. Magill [25] reported that the ability to provide students with proper feedback on their mistakes and achievement is the essential teaching behavior for physical educators. Limited effects of informational feedback have been reported on both student learning [22, 26] and motivation [18, 22]. Feedback that does not address specifics about student performance, namely general feedback, may, therefore, be beneficial to student affect and improve their motivation to persist in future participation [4, 20]. Others disagree as results of their studies have revealed little to no relationship between general feedback and motivation [17, 18].

Beyond determining the most effective types of feedback, researchers must consider how feedback affects students in different contextual settings, such as the frequency children participate in physical education. For example, in elementary schools, some students may receive physical education every day while others may only participate in physical education once each week. Physical educators who teach students less frequently are challenged to deliver the most effective and motivational physical education lessons to their students within their time constraints. This is especially true in light of research that shows that teachers administer, on average, only one or two feedback statements each minute during class [27]. And even then, the feedback is not equally distributed to students. While some students are given much attention, others

get none [15, 28].

Unlike previous feedback studies in physical education [10, 18, 29], this study examined the immediate effects of feedback. Pellett and Harrison [29] hypothesized on the ineffectiveness of observing feedback effects after long-term instruction. They caution long-term instruction may limit the study's conclusions because the results are impacted by process variables other than feedback, such as task presentation, implementation of accountability measures, and monitoring. These variables can impact feedback effects related to both student performance [29] and student motivation [17]. Researchers may gain a clearer picture of feedback effects by endorsing a research methodology whereby student's performance and feelings are measured immediately after the administration of the feedback [30]. Therefore, this study examined the effects of feedback after one experimental lesson.

The following research questions were developed to examine the influence of different types of feedback on perceived competence and student performance in physical education settings: (1) Does feedback type influence participants' perceived competence when considering pre- and post-task measures of perceived competence?; (2) Does feedback type influence participants' product performance when considering pre- and post-task measures of the product performance?; and (3) Does feedback type influence participants' process performance when considering pre- and post-task measures of the process performance? From the results of previous studies reporting on the effects of feedback, the researchers hypothesized there would be significant differences between pre- and post-task measures of perceived competence, product performance, and process performance among participants exposed to different types of feedback.

2. Methods

2.1 Participants and Setting

The participants in this study consisted of 113

students (45 males and 68 females), primarily between the age of 10 and 11 (92.9%). Students who reported themselves to be white (not Hispanic) made up a majority of the sample (61.1%) while those self-reporting themselves to be black or of African descent was the ethnicity with the next highest number of participants (17.7%). The participants were recruited from two elementary schools (66 from school A and 47 from school B) that are representative of many elementary schools in northwest Florida. The schools' population is from a medium size city and each schools' socioeconomic status and ethnicity are similar to each other. The students at school A were taught by two physical education teachers (one male and one female) while students at school B received their physical education instruction from three teachers (two male and one female). Students from both schools attended regular physical education class twice each week for 30 to 40 min each session. Consent and assent forms were approved by the researchers' Institutional Review Board and were each completed prior to the study.

2.2 Experimental Procedures

This study followed a pretest-posttest quasi-experimental design. Students at each school were organized into 21 randomly assigned groups (11 groups at school A and 10 at school B). Groups consisted of between four and six participants (groups with four = 1; groups with five = 11; groups with six = 10) and were assigned by convenience. One of two randomly assigned research group leaders led each participant group. The research group leaders were undergraduate students trained over seven meetings and 11 hours of practice to complete data collection, task presentations, and treatment delivery at 100% agreement with study expectations. Procedures for the experiment were divided into three stages. In the first stage, the group participants were randomly assigned a gray, blue, or black pinafore to differentiate the treatment received and completed the pre-task questionnaire.

During the second stage, group participants were placed in two lines where they received a lacrosse shot task presentation that included skill cues, demonstrations, and task directions. To delimit the potential effect of the introduction on skill performance change, all skill performances were completed after the task presentation. Each student subsequently performed the 5-shot pretest with no feedback. Participants continued attempting the lacrosse skill after the first five attempts without pause. During this practice time following the pretest, the leader for each group administered positive general feedback, informational feedback, and the control treatment (no feedback) to the participants according to pinafore color. Participants practiced alternately from line to line. One line was observed by the group leader and one line was not, resulting in participants receiving their assigned feedback treatment once out of every two lacrosse shot attempts for a total of six feedback statements. This format was created from a recommendation by Schmidt and Wisberg [31] who suggested that large amounts of feedback after every attempt may lessen the effects of the feedback. They further recommended administering small amounts of feedback on a continual regimen, which is more consistent with a regular physical education setting. Additionally, participants heard feedback offered to other participants during the practice session which additionally simulated the ecology of a normal physical education setting. Once participants had completed the 12 practice attempts with treatment, the research team member quietly observed participants take five final attempts without pause, which served as the posttest. In the final stage, participants completed the post-task questionnaire.

The general feedback used in the study was purposefully administered so that there were no informational or controlling effects on the participants (e.g., "Well done," "Good job"). Informational feedback in this study was corrective and prescriptive. The research team task presenter analyzed certain

participants' lacrosse skill attempts and corrected an aspect of each attempt that was considered either incorrect or that needed improvement (e.g., "Your hand placement is perfect," "Next time slide step toward the target"). Each example specified something congruent to the task presentation that needed to be considered in future attempts. The term corrective informational feedback describes all informational feedback in this study since prescriptive feedback includes comments about participants' performance that needs improvement. The provision of no feedback was strictly controlled (e.g., no facial expressions).

The researchers adopted the lacrosse shot skill because it is a skill that is relatively unfamiliar to this region of the United States. Playing lacrosse recreationally in this region is rare and many schools have yet to adopt units of study that endorse lacrosse. In fact, lacrosse is so novel in this region, most elementary schools lack the proper equipment to practice lacrosse skills. An unfamiliar task was important in this study because it eliminated past instruction and previous experience from establishing motivational or performance benefits before the experiment [18, 22, 23].

2.3 Instrumentation

3.3.1 Perceived Competence

Participants completed six items in the pre- and post-task questionnaires to determine participants' pre-task perceived competence. Participants answered these items on a 7-point Likert-type scale, ranging from "Not at all true" to "Very true." The perceived competence scale was adopted from a subscale of the Intrinsic Motivation Inventory [32] which was developed to assess study participants' subjective experiences in relation to experimental target activities. Though the items maintain a fixed format, the makeup allows for researchers to modify and adapt the instrument depending on the research questions that are being addressed (e.g., "The lacrosse shot was a skill that I could not do very well").

3.3.2 Performance Skills Test

Lacrosse skill performance was measured by performing the lacrosse skill five times before and after the feedback treatment. During the skills test, participants did not receive the feedback treatment. Silverman et al. [33] recommended a procedure similar to the one described here. They suggested pre- and posttests of skill be administered without feedback which will ensure that the influence of feedback during the practice session is most evident. Many instructional strategies and teacher behaviors can impact student achievement or performance, and a format such as the one utilized in this study was designed to isolate the effect of feedback. The number of shots that entered the goal out of five shots during the pre- and posttest, as evident in video recordings, was the participants' product performance score. Participants' product performance was determined through the observation of the participants' performance on videos. Following van der Mars [34] recommendation for intra-rater reliability analysis, two researchers scored the participants' pre- and post-task performance to decrease the limitations of rater bias. Inter-rater agreement for the product performance tests was found to be 0.99.

Process performance of a skill is an important variable to consider for student performance [33]. Process performance scores were determined with an analytic rubric instrument that was used to analyze six components of participants' lacrosse shot form. This instrument was a modified version of the Miller Amalgamated Striking Instrument (MASI) [35]. The six lacrosse shot components were developed by the goals outlined in the skill cue portion of the task presentation. The MASI used three levels of skill efficiency for each component, including initial, elementary, and mastery stages. Since the lacrosse skill was unfamiliar to the participants, there was not an expectation of mastery and the researchers developed the instrument with two levels of efficiency. The six items were rated as either the initial stage of efficiency

(scored 0) or the elementary stage of efficiency (scored 1) resulting in pre- and posttest scores ranging from 0 to 30. Test-retest reliability for all six components in the lacrosse process performance instrument was 0.91 for children between ages 8 and 12. The content validity for each component and stage description was established by the participants' teachers, movement specialists, and lacrosse skill descriptions as found in Fronske and Wilson [36]. The researchers used van der Mars [34] inter-rater reliability procedure and the resulting agreement for all pre- and post test attempts was calculated to be 0.87.

2.4 Data Analysis

Descriptive statistics were calculated for lacrosse experience and Cronbach's alpha was used for reliability testing. Three separate split plot 2×3 analysis of variance (ANOVA) tests with repeated measures were conducted to determine whether feedback treatment type influenced participants' perceived competence, product performance skill, and process performance skill when considering pre- and post-task measures. In each ANOVA, main and interaction effects were observed. Cohen's *d* was computed within each analysis by converting partial eta-squared to determine the effect size as a measure of the mean differences between the pre- and posttest. Effect size was calculated to determine the effectiveness of the treatment. Cohen's *d* effect sizes equal to 0.20, 0.50, and 0.80 are defined as small, medium, and large [37]. Analyses were performed using Statistical Package for Social Sciences version 22.0 and the level of significant was set at 0.05.

3. Results

Participants were asked to rate their lacrosse experience on a 9-point Likert-type scale from 1 ("Never heard of it") to 9 ("Expert"). A score of 5 represented a lacrosse experience rating identified as "Played some." Over half (54.9%) of the participants reported that they had never heard of lacrosse while

only three participants reported that they were experts. Those participants who reported a rating from 1 to 3 accounted for over 3-quarters of the sample (77.0%). Overall, participants considered themselves to have had little experience with lacrosse across the sample when considering frequency comparisons.

The pre- and post-task questionnaires were measured for reliability using Cronbach's alpha. Cronbach's alpha for the pre-task questionnaire was found to be reliable (six items; $\alpha = 0.74$) which indicates internal consistency and that the items are indeed tapping into the construct of perceived competence. The post-task perceived competence subscale was also found to have good internal consistency ($\alpha = 0.81$).

Reliability of the task presentation was measured using analyses of the actual script presentations in comparison to the actual script. Reliability using this type of analysis ensured that each group received the same task presentation. The videos for each task presentation ($n = 21$) were scrutinized and it was found that, overall, task presenters maintained a high percentage of accuracy to the actual script (98.5%), and is, therefore, considered a reliable task presentation. Similarly, the reliability of treatment conditions from the task presenter of each group ($n = 21$) was analyzed through video analyses. The feedback delivery was considered reliable as the feedback delivered was nearly the same in comparison with the feedback that was expected to be delivered (99.1%).

3.1 Perceived Competence

A Split Plot 2 (test) \times 3 (group) ANOVA with two levels in repeated measure (pre- and posttest) and a between-subjects effect (feedback treatment condition) with three groups was conducted to determine whether there was a statistical significance between pre- and post-task perceived competence when considering three different feedback groups. The result of the within-subjects contrasts was not significant [$F(1,110) = 0.126, P = 0.882$]. The main effect of the pre- and

posttest perceived competence scores was found to be significant [$F(1,110) = 27.758, P < 0.001$]. Using Cohen's d , the effect size of the main effect was determined to be 0.60, which is considered a medium to large effect size and indicates a relatively powerful treatment condition as a whole when considering participants' perceived competence from pre- to posttest. However, the main effect of the feedback treatment conditions was not found to be significant [$F(1,110) = 0.760, P = 0.470$], indicating there were no differences in the type of feedback when considering participants' perceived competence. A one-way between-subjects ANOVA was conducted to compare participants' pre-task self-reported perceived competence to those participants who received general, informational, and no feedback conditions. Participants were expected to begin the experiment with perceived competence scores that were not significantly different. According to the test, there was not a significant difference by group considering participants' pre-task self-reported perceived competence at the $P < 0.05$ level for the three conditions [$F(2, 110) = 0.417, P = 0.660$].

3.2 Product Performance

A Split Plot 2 (test) \times 3 (group) ANOVA with two levels in repeated measure (pre- and posttest) and a between-subjects effect (feedback treatment condition) with three groups was conducted to determine whether there was a statistical significance between participants' pre- and post-task product performance when considering three different feedback groups. The result of the within-subjects contrasts was not significant [$F(1,110) = 0.173, P = 0.842$]. The main effect of the pre- and posttest product performance scores was found to be significant at the 0.05 level [$F(1,110) = 8.535, P = 0.004$]. Using Cohen's d , the effect size of the main effect was determined to be 0.37, which is considered to be approaching a medium effect size and indicates a moderately effective treatment condition as a whole when considering participants' product

performance from pre- to posttest. However, the main effect of the feedback treatment conditions was not found to be significant [$F(1,110) = 0.054, P = 0.948$], indicating there were no differences in the type of feedback when considering participants' product performance. A one-way ANOVA was conducted to determine if there were any differences among feedback treatment groups in participants' pre-task product performance before the feedback treatment. No differences were found among feedback groups.

3.3 Process Performance

A Split Plot 2 (test) \times 3 (group) ANOVA with two levels in repeated measure (pre- and posttest) and a between-subjects effect (feedback treatment condition) with three groups was conducted to determine whether there was a statistical significance between participants' pre- and post-task process performance when considering three different feedback groups. The result of the within-subjects contrasts was significant [$F(1,110) = 5.493, P = 0.005$] which demonstrates that interaction effects existed and that there were significant differences in participants' pre- and post-task process performance scores among the feedback treatment conditions (Fig. 1). The main effect of the pre- and posttest process performance scores was found to be significant [$F(1,110) = 62.150, P = 0.000$]. Using Cohen's d , the effect size of the main effect was determined to be 1.45, which is considered a very large effect size and indicates a powerful treatment condition as a whole considering participants' process performance from pre- to posttest. The main effect of the feedback treatment conditions was also found to be significant [$F(1,110) = 3.933, P = 0.022$], indicating there were differences in the type of feedback when considering participants' process performance.

Since a significant F test was found, a post hoc Tukey's HSD test was conducted to further explore differences among means and to provide information on which means were significantly different from each other (Table 1). When considering participants' process

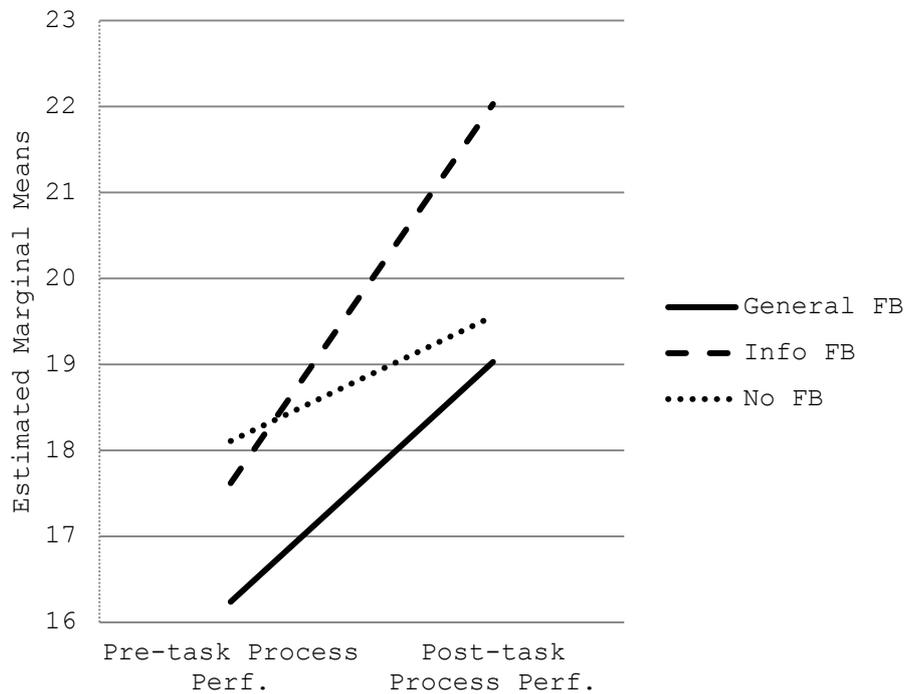


Fig. 1 Changes in process performance scores from before and after experiment by feedback treatment group.

Table 1 Tukey’s HSD Post Hoc Test.

Treatment Group	Treatment Group	Mean Diff.	Std. Error	Sig.
General FB	Informational FB	-2.19	0.781	0.016*
	No FB	-1.20	0.797	0.291
Informational FB	General FB	2.19	0.781	0.016*
	No FB	0.99	0.792	0.429
No FB	General FB	1.20	0.797	0.291
	Informational FB	-0.99	0.792	0.429

Note. The mean differences, standard errors, and significance levels of the interaction effects among the pre- and post-test process performance scores and feedback treatment conditions after conducting a Tukey’s post hoc test. FB = feedback; Diff. = difference; Std. = standard; Sig. = significance.

* $P < 0.05$

performance, a Tukey’s HSD test showed that participants had a significantly higher process performance improvement from pre- to posttest when participants received the informational feedback treatment condition as opposed to the participants who received the general informational feedback. No differences were found between participants receiving no feedback and general feedback. Likewise, no differences were found between participants receiving no feedback and informational feedback.

A one-way ANOVA was conducted to determine if there were any differences among feedback treatment

groups in participants’ pre-task process performance before the feedback

treatment. No differences were found among feedback groups. To further understand the results, a one-way ANOVA was conducted to determine if there were any difference among feedback treatment groups in participants’ post-task process performance measurement. The results of this statistical test were similar to those results found in the split plots ANOVA: a significant difference was found between groups and a Tukey’s HSD post hoc test showed only a significant difference between the informational feedback and the

general feedback group.

4. Discussion

The purpose of this study was to determine the effects of informational and non-informational feedback on elementary school physical education student's perceived competence and skill performance. Feedback treatment conditions included two experimental conditions, general and informational feedback, and a control group which received no feedback. General feedback, in this study, was a positive statement that was not intended to be specific to the participants' performance, while informational feedback was a statement correcting some aspect of the participants' skill performance.

4.1 Feedback and Perceived Competence

Harter [8, 9] suggested that incentives, general information, and evaluative information that take the form of positive feedback, as opposed to negative, will result in greater development of children's perceived competence. These postulations led to a prediction that participants in the current study who received general feedback would have a greater change in perceived competence than those who received no feedback or informational feedback. General feedback was given to participants in the form of positive general statements after every other lacrosse attempt during the task practice session. Therefore, it was considered to be positive feedback according to Harter's [8, 9] definition. Informational feedback was not accompanied by a positive statement and participants may have considered their performance a failure due to the corrective nature of the information. In alignment with Harter [8, 9], the researchers hypothesized that without receiving encouragement, students would have a negative or lack of competence. Similarly and according to Harter [8], a lack of feedback for task attempts should have the same effect on perceived competence as negative feedback.

Perceived competence was found in this study to be

significantly higher after the lacrosse task when compared statistically to perceived competence prior to participation, across the entire sample. However, no differences among the three groups were found. Even more interesting to note, the effect size of the lacrosse task as a whole was large. These results suggest that a teacher may design a lesson to promote skill practice, and, regardless of whether feedback is provided or the type of feedback given, students will improve perceptions of competence in their ability to perform the task. Since the effect size was so large, the researchers concluded that, overall, participating in the lacrosse task increased participants' perceived competence regardless of whether feedback was motivational, informational, or even if participants received any feedback at all. Merely participating in a task, in this study a relatively unfamiliar task, was enough to increase perceived competence for this sample of elementary school students.

Researchers exploring the effects of feedback on perceived competence have reported similar findings when compared to those reported in this study [17, 18]. Participants in the Fredenburg et al. [18] study completed pre- and post-task perceptions of ability surveys and no differences among feedback groups were found for change in perceptions of ability. The current study exposed no differences among groups but large mean differences did exist. Participants who received no feedback actually had the highest mean perceived competence gain (0.78) compared to the mean gain for the general feedback group (0.65) and the informational feedback group (0.63).

4.2 Feedback and Product Performance

In previous research, feedback was found to have inconsistent effects on students' performance. There are as many reports that support feedback as beneficial to student performance [18, 29, 33] as there are that report feedback to have limited to no effect on performance [22, 26, 30]. Among those researchers postulating feedback to positively affect performance,

there has been a general consensus that informational feedback has a greater proclivity to produce improved performance [18, 29, 33]. Therefore, the researchers hypothesized that there would be differences in the product performance between feedback treatment conditions. The type of feedback participants' received was not found to be an important factor in participants' product performance change, even though a significant difference was found from pre- to post-task assessment.

These results challenge previous results, such as those from studies by Rikard [30] and Masser [26]. Rikard [30] found that for fourth-grade students, informational feedback had a greater product performance effect on those students with low skills. Similarly, Masser [26] concluded that receiving feedback early in skill learning was important to product performance practice success but less important to those who had past experience and higher skill levels. Since participants in the current study were participating in an unfamiliar task, they were considered to be early in skill learning and should have, according to Rikard [30] and Masser [26], shown greater improvement in product performance. Nevertheless, participants who received informational feedback did not perform differently than students who received non-informational feedback and, though product performance improved, informational feedback provided no advantage.

Other studies have found that, when compared to each other, informational feedback had a significantly different and greater effect on students' product performance than general feedback [18, 33], regardless of skill level. However, these previous studies were performed over longer amounts of time than the current study. Participants in the Silverman et al. [33] study participated in a 7-day volleyball instructional unit while participants in the Fredenburg et al. [18] study worked on cup-stacking skills over four days. The lack of differences between feedback groups in the current study may have been explained by the smaller amount

of time participants spent practicing the lacrosse skill. Hebert and Landin [23] found evidence that would support this finding as they concluded verbal feedback as opposed to no feedback does not immediately influence product performance.

The conflicting results of the current study with those of previous studies may add important findings to feedback literature. In the current study, the procedures simulated a practice session that was short in length of time. Many students in elementary schools attend physical education as infrequently as once per week or less. The results of this study may imply that students who are learning an unfamiliar skill in elementary grade levels may be able to improve product performance at the same rates, regardless of the type feedback received from the teacher.

4.3 Feedback and Process Performance

The researchers posited that there would be significant differences in pre- to post-task process performance change among the feedback treatment conditions. A significant difference was found, specifically between the participants receiving informational feedback and the participants receiving positive feedback. No other differences between feedback treatment groups were found. These results seem to support the studies of Silverman et al. [33] and Fredenburg et al. [18] as they also found informational feedback to have a significantly different and greater impact on performance. However, those studies looked at the change in product performance as opposed to process performance. Process performance has been operationally defined in this study as skill form or qualitative performance of a skill, whereas product performance is a measure of skill outcome. Stroot and Oslin [10] stated that process performance is not important to immediate skill or product performance success, but it is important to improving skill success in the future. If physical education teachers are to be concerned about students' future performance of skill, specifically those students who are in the early stages

of learning the skill, process performance could be as important as or more important than the product performance.

Very few studies have examined the effects of feedback on process performance in physical education. Some time ago, Hebert and Landin [23] studied the process performance of an unfamiliar skill and found that process performance significantly improved when students were given a combination of general and informational feedback as opposed to no feedback. Similarly, Cohen [38] found that students who received informational feedback had significantly greater gains than those who received no feedback. The current study found no differences in process performance between students who received no feedback and neither informational nor general feedback which suggests a contradictory finding to those of Hebert and Landin [23] and Cohen [38].

The results of this study imply that when a physical educator desires to improve student skill form, offering informational feedback to students will result in the greatest improvements. The differences found between informational feedback and positive feedback could be explained by possible differences in student satisfaction of their individual performance attempts. Participants may have felt satisfied with their performance during the task since a significant other was stating that they were doing well and was giving them positive general comments, regardless of their performance. If participants were satisfied with their performance because of the feedback they were receiving, then they may not have made attempts to improve their form. Alternately, students who were receiving informational feedback may have recognized that they needed to pay closer attention to certain form deficiencies and therefore attended to the informational feedback they were receiving.

Since the findings demonstrate only a significant difference between informational and general feedback, conclusions reported in studies by Behets [39, 40] may offer the only explanation of this absence of a

significant difference between receiving information and receiving no feedback in the current study. Behets [39, 40] reported that there did not seem to be any advantages of using teacher feedback over silent monitoring. In a study of female college students, Behets [39] found that there were no differentiations between using and not using feedback when considering process performance scores. In another study of middle school students, Behets [40] concluded that teachers who provide less feedback and observe silently may actually promote greater student process performance. When the participants in the current study received no feedback, they may have made the decision to put more thought into their performance, in other words self-regulate their own form improvement. They may have analyzed other students who they thought were successful or they may have even listened to the feedback other participants were receiving. The conclusions of the current study do not lead the researchers to infer that there may be advantages to receiving no feedback over informational feedback. However, since there were no differences in process performance change between informational feedback and no feedback, this relationship needs further exploration.

5. Conclusions

Feedback may not have the impact on perceived competence and performance that quality lessons and instruction provides. During lessons, quality instruction should focus on students' process performance as students practice skills. Process performance improvement in elementary school physical education is the optimal achievement expectation since improved form predicts future product performance [10]. The results of this study support informational feedback as a vital teaching behavior in elementary school physical education, especially when the objective is to improve student skill form. These suggestions are especially important when students are learning unfamiliar skills and are

receiving physical education at a low frequency. Even though the results did not show positive general feedback to the optimal type of feedback, elementary school physical education teachers should adopt lessons and teaching behaviors that support students' pleasure in participation while protecting students from becoming involved in activity that may produce anxiety. Physical education lessons, like the one used in the current study, to teach skills should be informative, interesting, emotionally safe, and active.

Although important conclusions were drawn from the results, the researchers must acknowledge several limitations. First, feedback was carefully planned and was reliably delivered but students may have perceived the feedback differently than was intended. Future research may need to consider students' perceptions of the feedback to further understand the full impact of feedback. Second, the sample participants' questionnaire responses were a matter of personal perspective and could not be controlled. While measurement of a greater number of motivational constructs may have yielded greater information from which to postulate conclusions as to the effects of feedback on motivation, the participants age and time restrictions called for a shorter questionnaire. Future studies must consider more complex procedures when measuring psychological constructs at all elementary levels. Third, someone unfamiliar to the participants presented the task and provided feedback, as opposed to an actual significant or familiar other. This could have unexpectedly provided either positive or negative influences for the participants. Research with the actual physical education teacher in small units of slightly higher frequency (two to four lessons) would determine if the conclusions drawn in this study are normal. Finally, participants who did not, for example, receive feedback were able to hear feedback that was being offered to other students. It is unknown if "listening in" had an actual effect on participants' perceived competence or performance.

Although researchers continue to explore the impact

of feedback on student learning, there remains much to be learned about the impact of feedback on students. This study was designed to further the body of knowledge on this topic particularly as it relates to students' psychological state of perceived competence as well as their performance in physical education. Because feedback provided to students remains the most effective and readily available tool a teacher has to shape student learning beyond the design of the tasks students perform, it is imperative that we continue to learn more about this teaching behavior. As a result, future research building on these findings is warranted to be able to more confidently provide practicing and preservice teachers with more effective teaching strategies for the physical education classroom.

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