



## **Impact of Positive and Negative Motivation and Music on Jump Shot Efficiency among NAIA Division I College Basketball Players**

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### ABSTRACT

*International Journal of Exercise Science* 12(5): 100-110, 2019. The objective of this study was to determine whether music, positive feedback, and/or negative feedback impacted jump shooting performance in NAIA Division I male and female basketball players. Using a cross-over design, participants (N=20) took 50 shots from 15 feet and 50 shots from the 3-point line under four conditions (silence, music, positive feedback, negative feedback). The number of shots made were recorded and a one-way ANOVA was used to determine differences between gender. Repeated measures ANOVAs were used to determine differences between conditions in shooting performance and to identify differences in gender by condition. Analysis yielded no significant ( $p > .05$ ) differences between gender or gender by condition. However, significant differences ( $p < .05$ ) between conditions were noted, as participants had better shooting percentages in silence and music conditions compared to positive and negative reinforcement for shots from 15 feet. Participants also had better shooting percentages in the music condition compared to negative and positive feedback. Silence and music yielded significantly better shooting percentage compared to positive and negative feedback; however, these conditions did not necessarily mimic in-game conditions. Further research must be conducted on player performance during game time situations with negative and positive feedback from the crowd (i.e. home crowd versus away crowd).

**KEY WORDS:** Basketball, positive feedback, negative feedback, performance, collegiate

### INTRODUCTION

Music and motor behavior have been studied since the early 1900s (31). Research has shown that music can allow athletes to continue a physical task and delay muscle fatigue (24) and that “music distracts the individual from physical-effort-induced fatigue, removes mental agitation,

and serves as an exciting or soothing means before or during exercise” (40). Music has also been shown to benefit team sports by distracting attention from fatigue, moderating levels of arousal, and improving players’ mood (33). A recent literature review of music’s effect on sports and physical activity found that music was associated with beneficial effects on feelings, perceived exertion, heart rate, and performance (48). This review also found that music effects on performance did not significantly vary based on participants’ gender or age, whether music was used in a sport or exercise, whether music was used synchronously or asynchronously, or whether the researcher or participant chose the music type (48). Yet, other research has reported that musical preference can influence performance (6). Therefore, much remains unknown when considering if, when, and how music can be most effectively used to enhance sports performance.

Most recent studies on music and sport performance focus on individual-level performance related to maximal exercise, submaximal exercise, and exertion (11). While asynchronous music has been reported to reduce perceived exertion by about 10% (34), music has also been reported to improve endurance (45). Generally, music has been found to increase performance or peak or mean power (8, 12, 13, 20, 26, 27, 37, 40, 43, 46, 47, 50). However, a few studies have countered these (4, 39, 55). More specifically, one study reported that perceived effort was lower during slow and fast tempo music in comparison to no music (20). Another found that music can be as distracting as noise, and as a result, can negatively affect performance of a sports skill (14). Additionally, researchers report that music could be detrimental when an athlete generally performs exercises that require concentration and coordination (20).

Basketball is a game with many components (i.e., rebounding, passing, dribbling) of which shooting is arguably the most important motor skill because it requires coordination and concentration (15). Although athletes cannot listen to music during a game, music may improve performance during practice. Research has shown that listening to both slow and fast rhythm music increased heart rate significantly and improved performance among elite basketball players, but not significantly (42). Furthermore, there was no significant difference in performance between the fast and slow rhythm music. Others reported that music did not alter heart rate, perceived effort, or effect based on male or female recreational basketball players’ exposure to no music, fast tempo music, or slow tempo music (45). Interestingly, one-third of participants thought it was better to train with music, one-third thought it was the same to train with or without music, and one-third thought it was better to train without music (45).

In a study of undergraduate females shooting foul shots, no differences in foul shot effectiveness were observed based on presence of music or type of music (slow, fast, or personally selected) (22). In another study among three college basketball athletes, all participants improved their shooting performances with music, and two of three reported that music increased their perception of flow (35). Participants reported the music helped them control their emotions and cognitions, which in turn helped them enhance their performance. Finally, in a study examining ‘choking’ among experienced basketball players, athletes performed almost 20% better when shooting foul shots while exposed to music (32). These authors hypothesized that the music

served as a dual or distracting task that decreased the likelihood of focusing on pressure, which in turn allowed automaticity to occur and led to improved shot efficiency.

Vallerand and Reid (49) initially investigated the relationship between intrinsic and extrinsic motivation and sport performance. Cognitive evaluation theory and self-determination theory (18, 19) have been used to describe positive and negative feedback, autonomy, and intrinsic and extrinsic motivation. Numerous studies have shown that positive feedback positively affects intrinsic motivation pertaining to movement and sports (9, 21, 23, 24, 53, 54). While evidence supports that negative performance feedback decreases intrinsic motivation (17, 51, 52), the effect of positive feedback on performance is less consistent (3, 9, 16, 21, 23, 36). The literature shows that athletes have higher intrinsic motivation when positive feedback comes from a physical education teacher or coach (1, 2, 10, 28, 38).

There is limited research about the effect of motivation on basketball performance, and existing studies typically focus on motivation from a coach's perspective (7, 28, 30). To date, there is no research investigating the effect that auditory motivational statements might have on basketball shooting performance. While previous studies have evaluated the effect of music on free throw shooting in both basketball and netball, no studies have investigated other auditory methods as a means of motivation. Furthermore, no research has considered both male and female shooting performance beyond a free throw. Therefore, the purpose of this study was to examine the role of positive and negative reinforcement and music on the jump shot performance of male and female NAIA Division I college basketball athletes. We hypothesized there would be no significant differences between the type of reinforcement or music on jump shooting relative to silence.

## **METHODS**

### *Participants*

After obtaining Institutional Review Board (IRB) approval (#12.4-1) from Oklahoma City University, participants (N = 20; male = 10, female = 10) were recruited from men's and women's NAIA, Division One basketball teams at a university located in the Midwestern region of the United States. Participants signed an informed consent form prior to participation in the study. Ten of the 15 available male participants agreed to participate (67%), and 10 of the 14 available female participants agreed to participate (71%). No players who agreed to participate were excluded from this study. All participants ( $M_{\text{age}} = 21.50$ ;  $SD = 1.25$  yrs) were enrolled as full-time students and had a minimum of eight years of experience playing organized basketball.

### *Protocol*

This study was a randomized, crossover design with random allocation of the intervention using randomizer.org. Participants were required to randomly complete a trial without any sound (control), a trial using music (edited version of Rack City by Tyga), a trial using positive feedback ("great shot," "you've got this," "good shot," "there you go"), and a trial using negative feedback ("you suck," "off shot," "you can't shoot," "your shot is terrible"). The song was selected based on an iTunes recommendation for Hip Hop and not based on any participant or

research preference to reduce bias associated with personal music preferences and past associations with motivation or past performance. Their attitude towards the song was not measured.

Positive and negative feedback statements were pre-recorded into an Apple iPhone 5 (32GB) in 10-second increments and played back through the speaker of the iHome iDL95 Lightning Dock Clock Radio and USB Charge/Play throughout the duration of the trial. All participants performed solitary practice shots on the same basketball court using a Wilson Solution Game Ball. A 73.9cm basketball was used for male participants and a 72.4cm was used for female participants. Both balls were inflated to 8.0 psi.

Participants completed warm-ups, practice shots, and subsequent trials without the presence of spectators to eliminate the possibility of an audience effect. A pair of researchers acted as rebounders for the participants and ensured that the ball did not bounce back to the participant and interfere with their subsequent shot. Trials occurred at the same time of day (within 30 minutes of each other) to account for diurnal changes (5) and were completed a minimum of 48 hours apart. All warm-ups, practice shots, and subsequent trial shots were completed at the university basketball gymnasium where the team practiced and played in their games. Data were collected post-season to ensure that all participants had played on the court and were acclimated to the environment. Post-season records were used to confirm that all participants had played on the court and were acclimated to the environment.

Participants were asked to warm-up using the same routine they would normally use when competing in a basketball game. This included (but was not limited to) dribbling the basketball in place; practicing dribbling up and down the court; and shooting lay-ups, five-foot, ten-foot, fifteen-foot, and three-point shots. The shooting warm-up duration was between 10 and 15 minutes, depending on the participant's warm-up preferences. A set warm-up may have potentially altered the results if the participant did not engage in their typical routine used on a daily basis (6).

Once the participant declared themselves ready, they were provided with the opportunity to shoot 10 15-foot practice shots and 10 three-point practice shots (i.e., 20ft, 9in for men and 19 ft, 9in for women) using a basketball rack to confirm they felt comfortable in shooting. Participants were then asked if they felt comfortable and ready to begin the data collection. A shooting rack was used to eliminate the variances in passes that a rebounder might throw to the participant. Participants were then asked to shoot from five different locations (i.e., left and right baseline, left and right wing, free throw line) that were 15 feet from the basket (inside shots) and five different locations (i.e., left and right baseline, left and right wing, top of the key) that were at three-point distance (outside shots). Participants were asked to take the ball off a basketball rack and shoot the ball. The rack was placed next to the participant approximately 6 feet behind the spot where the participant was asked to shoot from. Participants were instructed not to dribble prior to shooting. There was no time restriction for shooting, and participants were asked to place the rack on whatever side they felt most comfortable. Participants kept the rack on the same side for subsequent days.

Following practice shots, participants completed all four trials at random. These included no noise, music, positive reinforcement, and negative reinforcement. The number of shots made and the total number of shots taken at each location was recorded. In each trial participants were asked to shoot 10 shots from 10 designated locations around the basket resulting in 100 shots. The order of shots started from 15 feet on the left baseline and then rotated counterclockwise around the basket at each of the remaining four stations. After the 15-foot shots were completed, the three-point shots started on the left baseline and were completed counterclockwise at each of the remaining four stations.

To begin each trial, participants were asked if they were ready and then the play button was pressed on the selected input before they began the trial. The duration that the participants listened to each input depended on the time taken to complete the trial because participants were permitted to shoot whenever they felt comfortable to do so (i.e., no time limit). All participants completed their shooting test within six minutes.

#### *Statistical Analysis*

All statistical analyses were performed using SPSS version 24.0. Descriptive statistics were calculated for all variables in the form of frequencies, percentages, means, and standard deviations. Prior to performing analyses of variance, data were screened for missing values and violation of assumptions. All assumptions were met for this data, and statistical significance was set at alpha level of less than .05. One-way Analysis of Variance (ANOVA) was used to determine differences between genders. A one-way repeated measures ANOVA was used to measure differences between conditions, and a 2 (gender)  $\times$  4 (interventions) repeated-measures ANOVA was used to measure differences between gender by intervention. Adjustments for sphericity when needed, were made using the Huynh-Feldt epsilon. Significant interactions were de-composed using t-tests and Bonferroni corrections were used.

## **RESULTS**

**Gender:** A series of one-way ANOVA revealed no statistically significant differences between gender for inside ( $F(78,1) = 1.096, p=.298$ ), outside ( $F(78,1)=.566, p=.454$ ), or total ( $F(78,1)=1.697, p=.197$ ) shooting percentage. (Table 1)

**Conditions:** A repeated-measures ANOVA revealed a statistically significant difference for inside shooting ( $F(3,57.00)=20.965, p<.001, \eta^2=.525$ ) and overall shooting ( $F(1.988, 34,372)=8.492, p=.001, \eta^2=.309$ ), but not for outside shooting ( $F(2.134, 40.554)=.981, p=.388, \eta^2=.098$ ). Post-hoc tests revealed significantly ( $p<.001$ ) better shooting percentage from inside for silence ( $72.2\% \pm 7.40$ ) compared to positive ( $61.9\% \pm 8.25$ ) ( $t(19)=4.210, p<.001$ ) and negative reinforcement ( $60.5\% \pm 5.50$ ) ( $t(19)=5.756, p<.001$ ). In addition, participants' inside shooting was significantly better ( $p<.001$ ) with music ( $75.2\% \pm 6.66$ ) compared to positive ( $61.9\% \pm 8.24$ ) ( $t(19)=5.748, p<.001$ ) and negative reinforcement ( $60.5\% \pm 5.50$ ) ( $t(19)=7.504, p<.001$ ); however, there was no difference between silence and music ( $p>.05$ ). Participants had a significantly better ( $p<.001$ )



overall shooting percentage for music (70.05% ± 4.72) compared to positive (63.65% ± 4.42) and negative reinforcement (62.40% ± 3.02).

Gender by condition: A 2 (gender) x 4 (conditions) found no statistically significant difference between genders.

**Table 1.** Accuracy Scores by Gender

Mean Accuracy Scores by Gender (average number of shots made per 50 shots [shooting percentage])				
Distance	Male		Female	
	Mean	SD	Mean	SD
Inside	34.3 (68.6%)	4.2 (8.3%)	33.2 (66.4%)	5.2 (10.4%)
Outside	32.3 (64.7%)	4.24 (8.5%)	31.7 (63.4%)	3.1 (6.2%)
Overall	33.3 (66.6%)	3.2 (6.4%)	32.4 (64.9%)	2.7 (5.4%)

**Table 2.** Accuracy Scores by Intervention

Mean Accuracy by Intervention (average number of shots made per 50 shots (shooting percentage))											
Intervention	Silence		Music		Positive Reinforcement		Negative Reinforcement		Post-hoc	η <sup>2</sup>	Power
	Means	SD	Means	SD	Means	SD	Means	SD			
Distance											
Inside**	36.1 (72.2%)	3.7 (7.4%)	37.6 (75.2%)	3.3 (6.7%)	31.0 (61.9%)	4.1 (8.3%)	30.3 (60.5%)	2.8 (5.5%)	S>P, N M>P, N	.525	.991
Outside	30.8 (61.5%)	5.4 (10.9%)	32.5 (64.9%)	38.4 (7.7%)	22.7 (65.4%)	2.8 (5.5%)	32.2 (64.3%)	1.7 (3.4%)	N/A	.098	.151
Total**	33.4 (66.9%)	3.9 (7.7%)	35.0 (70.1%)	2.7 (4.7%)	31.8 (63.7%)	2.2 (4.4%)	31.2 (62.4%)	1.5 (3.0%)	M>P, N	.309	.952

Note: \*\* p < .01

**Table 3.** Accuracy by Intervention by Gender

Mean Accuracy by Intervention by Gender shooting percentage										
Intervention	Silence		Music		Positive Reinforcement		Negative Reinforcement		η <sup>2</sup>	Observed Power
	Male	Female	Male	Female	Male	Female	Male	Female		
Distance	Mean	Mean	Mean	Mean	Mean	Mean	Mean	Mean		
	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)	(SD)		
Inside	69.8 (8.9%)	74.6 (4.8%)	77.4 (4.3%)	73.0 (8.0%)	65.2 (4.1%)	58.6 (10.1%)	61.8 (5.9%)	59.2 (5.0%)	.125	.602
Outside	61.2 (13.4%)	61.8 (8.4%)	66.2 (5.0%)	63.6 (7.1%)	66.2 (8.4%)	64.6 (6.1%)	65.0 (4.2%)	63.6 (2.3%)	.009	.071
Total	65.5 (10.2%)	68.2 (4.1%)	71.8 (4.1%)	68.3 (4.9%)	65.7 (2.6%)	61.6 (5.0%)	63.4 (2.5%)	61.4 (3.3%)	.090	.365

## DISCUSSION

The present study evaluated the effect of music and positive and negative feedback on inside, outside, and overall shooting percentage among male and female basketball players. No

significant differences were found by gender for shooting, which supports previous research (48). However, significantly better shooting percentages were observed for the music and silence conditions relative to the positive and negative reinforcement conditions.

There was no significant difference for music versus silence, which confirms findings from previous research (22); however, their study focused on free throw shooting while the current study focused on jump-shooting. These results contradict other studies (32, 35) that reported music improved shooting performance relative to silence. However, participants in these studies reported that music allowed them to focus and shoot better by helping them control their emotions and cognitions and block out distractions.

While this study did not evaluate why music and positive or negative motivation affect shooting performance, shooting performance was higher when players were exposed to silence or music compared to positive or negative verbal feedback. Although decibel levels were not measured in our current study and may have been lower than what players experience during a game, we postulate that verbal cues and verbal motivation may lead to distractions for basketball players when they are in the process of shooting. In our study, participants were exposed to random positive and negative verbal statements, which do not mimic real game situations where individual statements may be drowned out by the entire crowd screaming. Our study did not account for when verbal statements were made during the shooting process because they were pre-recorded and played every 10 seconds (not mimicking real game situations). As such, the statements may or may not have been playing when the participant actually took a shot. Further research should be conducted using real game sounds like boos and cheers and chants like "defense" to see the effect it has on shooting among athletes during practices and games.

Study findings should be considered in conjunction with its limitations. The sample size was small (N = 20) with small to moderate effect sizes. A larger sample size may have yielded differences by gender or for music or motivation, for example. An a priori power analysis was not performed to determine the number of shots that needed to be shot from each location. A post-hoc power analysis revealed that a sample size of 30 (i.e., 15 per gender) would be needed to see a statistically significant difference between gender by intervention for inside shooting. Additionally, we did not control for prior night's sleep, alcohol, caffeine intake or previous exercise, which may have influenced shot performance on the day of testing. The study was conducted with college basketball players in the NAIA and only at one school in the Midwest, whereas a larger study with more schools, athlete divisions, and geographical regions could yield different results. Another limitation was that all participants were volunteers and of similar ages, and while each had at least eight years of experience playing basketball, having participants from different age ranges or varying levels of experience could change the results. Musical choice and preference may have also been a factor. Baghurst et al. (6) demonstrated that musical type may affect performance, which suggests future studies should consider allowing participants to select their own music. However, many athletes are not permitted to listen to their preferred music during practice or a game (often music is only used during warm-up or cool-down). Conversely, positive and negative motivation in the form of feedback occurs during every game coming from the coaches, fans, teammates, and opposing players. Further research

into basketball shot performance should include the sounds that actually take place during a game like crowd noise, cheers, chants and boos, to see what effect this training can have during practice shooting and games. Considering these limitations, further studies are required to understand these differences and to determine the role that music and positive and negative feedback has on collegiate basketball players' shooting efficiency.

While this study did not lead us to conclude why there were differences in jump shooting for collegiate basketball players regarding music, silence, and positive and negative motivation, findings suggest that verbal cues and verbal motivation may lead to greater distractions for basketball players when they are in the process of shooting. This study found no gender-based differences for inside or outside shooting or for outside shooting and the intervention. However, significant differences were noted for the intervention and inside shooting, and results approached significance for intervention by gender and inside shooting. Overall, the players (both men and women) shot the ball better in silence and with music relative to verbal motivation (positive or negative). Men seemed to shoot better than women with no music, but women shot better with music, positive motivation, and negative motivation. Further studies will elucidate more data regarding music, silence, and verbal motivation and the performance of the basketball shot.

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