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Evaluating a Behavioral Intervention for Performance Blocks in Gymnastics

by

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A thesis submitted in partial fulfillment of the requirements for the degree of
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ABSTRACT

The purpose of this study was to evaluate a gradual exposure and thought training treatment package to increase gymnasts’ successful completion of a performance block skill. Following baseline, the researchers implemented both a thought training procedure to alter participants’ negative thoughts into positive thoughts, and a gradual exposure procedure which included gymnastics drills that were small approximations to the performance block skill. A 2-point rating scale was used to indicate successful completion of the skills: 0= refusal, 1= the participant initiated the skill but failed to complete it successfully, 2= the participant initiated the skill and completed it successfully. Rating scale scores, latency, and Subjective Units of Discomfort Scale (SUDS) (Abramowitz et al., 2011) were measured during baseline, the gradual exposure and thought training package, and follow-up. The Sport Anxiety Scale-2 (SAS-2) (Smith et al., 2006) was used to measure anxiety levels of the gymnasts at baseline and follow-up. The results showed that all three participants completed their performance block skill successfully during the post-treatment and follow-up sessions.
CHAPTER ONE: INTRODUCTION

In 2017, approximately 4.81 million individuals above 6-years-old participated in competitive and noncompetitive gymnastics (Gough, 2021). Competitive gymnasts face challenges that include, but are not limited to, performing fear inducing skills, fatigue, distractions, intensity of training, perseverance, post-injury training, stress before and during competitions, stopping in the middle of a skill being executed, and balancing gymnastics with school and social activities (Blijlevens, 2019). Such challenges can be difficult or even dangerous at times and may lead to injury (Thomas & Thomas, 2019). Westermann et al. (2015) conducted a retrospective review of injuries within one men’s and women’s Division 1 team over 10 seasons. The researchers discovered 201 injuries of the 55 female gymnasts and 240 injuries within the 64 male gymnasts. Of the 441 total injuries, 97 were rated as major. Furthermore, 70% of elite gymnasts struggle with performance blocks (USA Gymnastics, 2009), defined as having anxiety symptoms while failing to complete a skill that was previously considered mastered (Bennett et al., 2015; Bennett & Maynard, 2017; Day et al., 2006; Howells, 2017; Mace, 1986; Walker & Blom, 2021). Simone Biles, a famous gymnast winning seven Olympic medals in 2016 and 2020 (International Olympic Committee, 2022), is a good example because she withdrew from the 2021 Olympics after experiencing the “twisties,” a type of performance block (Nagesh, 2021). Performance blocks can interfere with peak performance and create the risk of severe injury. This paper will evaluate performance blocks and methods to treat them, including
reduction in anxiety and latency to complete a skill, in an effort to promote peak performance and reduce injuries in gymnastics.

The term ‘performance block’ has been described in a variety of ways; lost movement syndrome (LMS), mental block, and the yips are a few examples (Bennett et al., 2015, 2017; Day et al., 2006; Maaranen et al., 2017; Mace et al., 1986). Bennett and Maynard (2017) defined performance blocks as ‘freezing up,’ or the impermanent loss of control within a skill that may be accompanied by muscle tension, shaking, anxiety, or frustration. The separate ways in which a ‘performance block’ has been defined (e.g., LMS, mental block, and the yips) encompass failing to initiate or complete a gymnastics skill when previously capable, or changing skills midway through a skill (Bennett et al., 2015; Bennett & Maynard, 2017; Day et al., 2006; Howells, 2017; Mace, 1986; Walker & Blom, 2021). Performance blocks may occur after witnessing a significant injury, may include fear of failure and/or injury, and may start as an initial balk (exiting a skill midway through the execution) (Chase et al., 2007; Day & Schubert, 2012; Maaranen et al., 2017). Walker and Blom (2021) described performance anxiety as “an unpleasant psychological state which occurs under stress concerning the performance of a task under pressure” (p. 8). Negative affect or negative self-talk component has also been associated with performance blocks (Bennett et al. 2015; Day et al., 2006; Pattison & Cotterill, 2017). From a behavioral perspective, if the athlete experiences unpleasant thoughts or emotions when preparing to execute the skill, refusal to do the skill, exiting the skill, or doing a different skill would be negatively reinforced by escape from the unpleasant thoughts or feelings.

Several interventions for performance blocks have been discussed in psychology journals, however, performance blocks are typically reported subjectively and there has yet to be an objective measure of a performance block. Subjective measures of anxiety include
questionnaires, or anecdotal information from oneself or others. Objective measures of performance consist of direct observation and measurement of the behavior such as heart rate, latency to perform, or refusal to perform. Coping strategies, minimizing risks, cognitive strategies, and self-regulatory strategies have been reported to be useful in overcoming a performance block (Chase et al., 2007; Day & Schubert, 2012; Pattison & Cotterill, 2017; Walker & Blom, 2021). Day and Schubert (2012) discussed coping strategies that could be useful when dealing with a performance block. The gymnast must gradually accept the idea that falling and getting hurt is possible. They can learn to minimize this risk by increasing safety measures, such as using more safety mats and practicing the skill more. Chase et al. (2007) described how some gymnasts are afraid of injuries due to experiencing a painful incident. In this case, the researchers suggested the use of imagery and relaxation strategies. The researchers also discussed four facilitators to reduce a performance block: preparatory skills, encouragement by teammates, good coaching, and utilizing cognitive skills (e.g., visualizing, modeling, self-talk, Pattison & Cotterill, 2017).

A number of interventions have been reported to decrease performance blocks. Bennett et al. (2017) used eye movement desensitization and reprocessing (EMDR) therapy with graded exposure to treat a golfer’s performance block. The researchers assessed the intervention using the Impact of Event Scale and subjective units of distress. EMDR combined with graded exposure was shown to be an effective intervention for the golfer’s performance block as indicated on these self-report measures. Psychological skills training (PST) has also been used to help a 9-year-old gymnast with her fear of performing a beam skill. PST consisted of goal setting, imagery including the use of an audio script, and relaxation techniques. However, because an acceptable research design was not used, it is unclear whether the intervention was
the reason for her success. It is also unclear which part of the intervention resulted in improvement, due to there being multiple components (Howells et al., 2017). Mace (1986) used stress inoculation training to treat a performance block similar to how one would treat PTSD, including eight treatment sessions using education, rehearsal, and application procedures. Although the researchers reported that these interventions resulted in successful treatment of the performance blocks, they lacked an objective measurement of the improvements.

Gradual exposure (also called in vivo exposure), in which the individual moves through a hierarchy of steps that get increasingly closer or more similar to the feared stimulus, is a behavioral technique commonly used to treat anxiety (Miltenberger, 2016; Sherman 1972). For example, Sherman (1972) gradually exposed participants to water activities in a swimming pool to decrease their swimming anxiety. In Grider et al. (2012), a man with autism had a fear of getting his blood drawn. Gradual exposure was used along with positive reinforcement and stimulus distraction to increase his compliance with having his blood drawn. However, gradual exposure has rarely been used in behavior analysis to treat fears or phobias in sports.

Gustafsson et al. (2017) used in vivo exposure to help a 17-year-old cross-country skier decrease performance anxiety related to uphill skiing. The participant described having exhausted herself while training too hard. During one competition, she finished last, became anxious about competitions, and started engaging in avoidance behaviors. She skied slower or completely avoided uphill segments to decrease her anxiety. The intervention began with an assessment using the subjective units of discomfort scale (SUDS) to create an exposure hierarchy of avoidance behaviors. The second phase of the intervention involved psychoeducation in which the researchers educated the skier about her “dysfunctional behaviors… their functions, and the rationale for the intervention” (p. 156). The third phase of the intervention included exposure to
physical sensations such as shortness of breath, dizziness, and increased heart rate to teach the participant that these symptoms of anxiety are harmless. The fourth phase of the intervention incorporated exposure in vivo, in which the participant had to experience anxiety provoking stimuli to realize there was no legitimate threat. The participant’s anxiety decreased from 80 to 50 out of 100 on a self-rating scale during the uphill segment. The researchers gave her a homework assignment to complete to do increasingly more uphill training. The fifth phase of the intervention involved reviewing the work the participant completed the prior week, creating a plan, and scheduling a booster session for two months later. The booster session involved a discussion on the participant’s progress, revealing that the participant maintained the skills and her anxiety continued to be lower than at the start. The sixth phase evaluated the intervention. The participant reported she was no longer engaging in avoidance behaviors, skied uphill without anxiety, was able to ski with friends, and resumed participation in competitions. This study incorporated subjective measures such as the SUDS and anecdotal reporting of improvement in performance. Although this study used gradual exposure techniques and reported anecdotal information on improvements in avoidance behaviors, no objective measure of performance was reported. No studies have reported an objective measure of the avoidance behaviors that occur as a result of fear in an athletic context.

Rational Emotive Behavioral Therapy (REBT) is another method that has been used to treat anxiety disorders and consists of the following components to help clients “(a) identify their irrational beliefs, (b) recognize that the irrational beliefs are maladaptive, and (c) replace those dysfunctional cognitions with more adaptive beliefs” (DiGuisepppe & David, 2015, p. 156). REBT typically includes some form of a 13-step model, but briefer versions of the procedures have also been evaluated (Bowman & Turner, 2022; DiGuisepppe & David, 2015; Malkinson,
Bowman and Turner (2022) used a technique based on REBT. They evaluated REBT-informed single-session therapy (SST) on social anxiety of five golfers using a single-case, multiple-probe, ABA design. The researchers used golf-specific anxiety (GSAQ) questionnaire, irrational performance beliefs inventory (iPBI), the Liebowitz Social Anxiety Scale (LSAS-SR), and the Short Warwick-Edinburgh Mental Well-being Scale (SWEMWBS) to measure performance anxiety, irrational beliefs, and well-being. The intervention consisted of one face-to-face REBT session. The participants completed a handwritten GABCDE worksheet: (G) goals, (A) sticking to the goals, emotional and (B) behavioral (C) consequences, irrational beliefs are (D) disputed, (E) effective rational beliefs are created and reinforced. All but one participant had a reduction in “irrational performance beliefs, golf specific anxiety, and social anxiety” (p. 7). Again, no behavioral measures of improvement in performance were included.

Sport psychology research has identified the anxiety related characteristics of performance blocks and has found cognitive behavioral treatments (including gradual exposure and thought re-training procedures) to be effective in decreasing self-reported anxiety levels. However, there has yet to be an objective measure of a performance block to evaluate behavioral treatments. Therefore, the purpose of this study is to evaluate a behavioral intervention consisting of gradual exposure and thought training based on REBT, to decrease performance blocks in gymnasts by using objective measures.
CHAPTER TWO: METHOD

Participants and Setting

Three female gymnasts participated in this study. Kayla (age 11) competed on an excel gold level gymnastics team in west central Florida. Cassie (age 11) competed on a level 5 compulsory gymnastics team in southeast Florida. Caitlyn (age 7) did recreation gymnastics in southeast Florida. Caitlyn’s coach reported her as approximately a level 3 gymnast. Level 3 is the level at which competition begins and is characterized by basic skills, such as a handstand forward roll, round-off back handspring, and handstand to a bridge kickover. Each gymnast’s coach was also recruited to participate in this study. Cassie and Caitlyn had the same coach. The researcher provided coaches with a recruiting flier with the description of the study to distribute to the gymnasts and their parents. Gymnasts who met the following criteria were included in the study: refused to complete a gymnastics skill on any apparatus when previously mastered, executed a different skill midway through a skill chain, did not land a skill when previously mastered, and/or exhibited an unacceptable latency to initiate the skill. The coach determined refusal if they reported that, for at least two weeks, the gymnast had not initiated the skill more than half the time. “Previously able” to execute the skill was determined by the coach if they reported that the gymnast had successfully completed the skill consistently for at least one month. Participants in this study must have been willing to train at least two times per week. Participants were excluded from the study if they had an injury preventing them from performing the required gymnastics skills. The participants’ performance block skills were at or below level
due to safety considerations. As another safety consideration, gymnasts were excluded if the coach reported that the gymnast tended to balk. The participants were also excluded from the study if the coach reported that they refused to participate in other aspects of practice besides the performance block skill.

Kayla’s performance block skill was jumping from the low bar to the high bar. This included her completing a cast squat on the low bar, then standing up and jumping to the high bar. In order for the skill to be considered completed, Kayla must have caught the high bar and held on for at least one full swing. Cassie’s performance block skill was pausing during a roundoff back handspring. The roundoff and back handspring had to be connected without a pause to be considered completed successfully. Caitlyn’s performance block skill was failing to complete a standing back handspring on the tumble track. In order for this skill to be considered completed successfully, she had to land on her feet.

Materials

Materials included gymnastics mats for safety, equipment used for the drills, such as an inclined mat, pac-man mat (a mat shaped as a pac-man to help teach back handsprings to gymnasts), or resi mat (an elevated soft mat filled with cushion) which varied depending on the skill being performed. Data were collected using a data sheet, a stopwatch, and an iPad to video record. A jar and candy were used for the incentive component for Kayla.

Dependent Variable and Data Collection

A performance block was the term given to the following behaviors: exhibited a longer latency to initiate the skill than the mean latency for a nonperformance blocked skill (normative latency), refused to perform a previously mastered skill on any apparatus (such as refusing to do a back handspring on the balance beam when previously able, but completing it on the mat, or
refused to do a back handspring on any apparatus), executed a different skill midway through a skill chain (such as doing an aerial but putting hands down [now it is a cartwheel], or did a back tuck but reached for the ground [now it is a back handspring]), and failed to land a skill when previously mastered. A rating scale was used as the primary dependent variable to score the behavior using the following numerical values: 0= refusal, the gymnast did not initiate the performance block skill within 30 s from the time the researcher gave the prompt to do the skill, or if they stated a verbal “no,” 1= the participant initiated the skill but failed to complete it successfully. For Cassie, this included if she did the round off and back handspring but failed to connect them without a pause. A score of 2= the participant initiated the skill and completed it successfully. For Cassie, this included if she connected the round off and back handspring without a pause. The secondary dependent variable was the latency to perform the skill; latency was measured from the time the researcher prompted the participant to initiate the skill to the moment their feet lifted off the floor. The latency score was reported as the number of seconds to initiate the skill up to a maximum of 30 s.

The researcher gave a prompt and pressed start on the stopwatch. The researcher stopped the stopwatch as soon as the gymnast initiated the skill (their feet lifted off the ground). The gymnast got a brief break after the trial and the researcher waited 30 s before having the gymnast approach the line and provided the next prompt to perform the skill.

The researcher also included the Subjective Units of Discomfort Scale (SUDS) (Abramowitz et al., 2011) to measure the anxiety levels of the participants during each execution of the skill in baseline, the first attempt at each gradual exposure level, and follow-up. The SUDS included a scale of 0-10 to determine the relative discomfort levels of the gymnast the moment they were about to initiate the skill. For example, the researcher asked the gymnast, “on
a scale of 0-10, 0 being no discomfort and 10 being extreme discomfort, what is your current level of discomfort?” The Sport Anxiety Scale-2 (SAS-2, Smith et al., 2006) was used to assess anxiety levels pre-treatment and post-treatment (during baseline and follow-up). The SAS-2 included 15 questions separated into categories such as somatic anxiety, worry, and concentration disruption (see Appendix B).

**Interobserver Agreement**

The researcher was the primary observer and data collector. The second observer was trained to record the rating scale scores and latency to initiate the skill; they recorded these in at least 30% of the sessions. The researcher used behavioral skills training to train the research assistants to record the behavior from video recordings. Once the second observer was trained to 90-100% agreement across at least three practice videos, they scored the data from video of actual observation sessions with the participants. The agreement on rating scale score was calculated by dividing the smaller score by the larger score and multiplying by 100. The agreement on latency was calculated by dividing the smaller latency by the larger latency and multiplying by 100. If the agreement between observers fell below 90%, retraining occurred.

Interobserver agreement for the rating scale score was calculated for 36% of sessions for Kayla, 35% of sessions for Cassie, and 36% of sessions for Caitlyn. Interobserver agreement for latency was calculated for 33% of sessions for Kayla, 33% of sessions for Cassie, and 32% of sessions for Caitlyn. The percent agreement for the rating scale score was 99% (range 50% to 100%) for Kayla, 95% (range 0% to 100%) for Cassie, and 100% for Caitlyn. The percent agreement for latency was 99% (range 64% to 100%) for Kayla, 100% for Cassie, and 98% (range 57%-100%) for Caitlyn.
Treatment Integrity

A second researcher observed the researcher implement the intervention and completed a checklist (see Appendix C) to record whether the steps in the intervention procedure were completed correctly. The researcher followed the checklist displayed in Appendix C. Treatment integrity was calculated for at least 50% of intervention sessions by dividing the number of steps completed correctly by the total number of steps. Treatment integrity was at 99% across 56% of sessions for Kayla, 100% across 51% of sessions for Cassie, and 97% across 58% of sessions for Caitlyn.

Social Validity

Upon the completion of the study, a survey with items scored on a 5-point Likert scale (1= strongly agree and 5= strongly disagree) was provided to the gymnasts, coaches, and parents to assess their opinion on whether the gymnasts’ performance blocks decreased, the likelihood of implementing these procedures in the future, whether the duration of the procedures was reasonable, and whether they were likely to recommend this procedure to others (Appendix D).

All three participants, their parents, and coaches strongly agreed that the procedures were beneficial (score of 1). All strongly agreed that the gymnast’s performance block decreased (score of 1), with the exception of Caitlyn’s parent, who agreed, rather than strongly agreed, that Caitlyn's performance block decreased (score of 2). Kayla and Kayla’s coach scored the statement, “this study took too much time,” as a 3 or neutral. However, all other participants scored this statement as a 5 (strongly disagree). Kayla’s coach strongly disagreed with the statement, “I am likely to implement these procedures in the future to help other gymnasts with performance block.” She further elaborated that she personally would not take the time to implement these procedures but would be open to someone else working with her gymnasts. All
other participants strongly agreed with this statement indicating they are likely to implement these procedures in the future. Kayla’s coach agreed with the statement, “I would recommend this intervention to other coaches or gymnasts.” All other participants strongly agreed with this statement.

**Experimental Design and Procedures**

A nonconcurrent multiple-baseline design across participants was used to evaluate the effectiveness of the gradual exposure and thought training procedures.

**Interviews**

The researcher interviewed the gymnasts and their coaches to learn about how the gymnast’s performance block developed, what the performance block looked like, and what the gymnast was thinking as the block occurred. See appendix E and F.

Kayla’s performance block was jumping from the low bars to the high bars. Kayla’s coach stated that Kayla would avoid practicing the skill, would only attempt it with physical guidance and would not complete the skill regardless of the bars proximity to each other as she was scared of “peeling off,” or releasing the bar too early. According to her coach, Kayla was not forced to perform the skill but would receive praise if she did complete it. Previous attempts to overcome her performance block included: using a smaller or wider bar setting, spotting her (physical guidance), and having her jump off a foam block closer to the bar. No previous intervention resulted in Kayla completing the skill. Her coach reported that Kayla performed the skill before breaking her foot (unrelated to gymnastics), but when she returned to gymnastics post-recovery, she would not catch the bar. Her coach attributed Kayla’s performance block to the following potential causes: her injury, fear of height, lack of confidence in her ability to hold her weight, and fear of peeling off and landing on her back.
Kayla reported having negative self-talk before attempting the skill and after failing to complete the skill. Kayla stated she was never reprimanded for failing to complete the skill but understood the consequences if it occurred in competition. When asked for the most and least helpful strategies she reported warming up on the small setting and having spot as most helpful and being told “do it” as least helpful.

Cassie’s performance block included connecting a round off back handspring. Cassie’s coach reported that she could complete the skill on a tumble track, but it would take a few attempts.

Cassie stated, “I’m scared to do the back handspring, which leads to not doing the back tuck or anything else.” Because of her performance block, she avoided the round off back handspring in her routine and replaced it with a front handspring round off back tuck, which is a higher difficulty level. Cassie stated she inconsistently connected the round off back handspring with a spot. She thought her performance block was a result of watching other gymnasts struggle with their performance blocks. Cassie reported that her performance block was recurring, and she overcame prior blocks by talking about the skills, practicing the skills, and completing drills. When asked for the most and least helpful strategies she reported that coaches getting mad and putting pressure on her was least helpful.

Caitlyn’s performance block was a back handspring. Caitlyn’s coach reported repeated hesitation in Caitlyn initiating or attempting the skill. Her coach stated that Caitlyn was motivated by her coaches’ approval, but her body language showed that she did was not confident.

Caitlyn said that she wanted to perform a back handspring at the show, but “I can’t really because my mind is telling me I can’t do it, but I know that I can do it.” She reported that she had
previously fallen while attempting the skill and became scared of jumping despite not getting hurt. When asked for the most and least helpful strategies Caitlyn reported repeated encouragement and/or a light spot by a coach using four fingers, then three fingers, then two fingers, then one finger was most helpful.

**Baseline**

During baseline, the researchers directed the gymnasts to say when they were ready. Once they verbally stated that they were ready, the researcher prompted the gymnast to do the gymnastics skill, such as “do a back handspring.” After the gymnast completed the skill, the researcher asked the participant to report their anxiety level using the SUDS and recorded latency on the skill about which the gymnast had the performance block. The researcher started the stopwatch once the prompt was given and stopped the stopwatch when the gymnast’s feet were off the ground. The researcher thanked the participants for their participation but provided no feedback on the skill. The researcher prompted the gymnast to perform the skill and recorded the latency at least five times. The researcher gave the gymnast a 30 s break after each trial before asking the gymnast if they were ready and presented the prompt to perform the skill again. If the gymnast engaged in balking (exiting a skill midway through the execution), the researcher stopped conducting baseline and moved onto intervention (or terminated the subject’s participation if there were not enough baseline data points for research design standards).

**Intervention**

Thought training and gradual exposure procedures were implemented to decrease the latency and anxiety levels of the gymnasts.

**Thought Training.** The thought training component was based on the Rational Emotive Behavioral Therapy (REBT) procedure by DiGuisepppe and David (2015). The researcher
described the gradual exposure and thought training procedures to each participant. By knowing that they started with easier skills that they have mastered, the participants were able to easily comply with the thought retraining procedure that required them to practice positive thoughts to replace negative thoughts about their performance. The thought training component consisted of a discussion with the gymnasts to determine the negative thoughts they experienced before they attempted their skill. The researchers provided a brief description of the connection between the emotional and behavioral consequences of the negative thoughts related to the performance block, and the connection between positive thoughts and skills without a performance block. The researcher then helped the gymnasts generate positive, more realistic thoughts to replace the negative ones. These positive thoughts were believable to them as they worked on mastered skills in the hierarchy. During intervention, each time the gymnast stated they were ready, the researcher prompted the gymnast to state their positive thoughts and the gymnasts repeated the alternative positive thoughts aloud for approximately 15 s. For example, the gymnast confirmed that they were ready, the researcher stated “Kayla, say your positive thoughts aloud.” After the participant stated their two or three positive thoughts aloud, the researcher prompted the skill, “do a back handspring.” This occurred during each trial of every step during intervention.

**Gradual Exposure.** Similar to the study by Gustafsson et al. (2017), the researchers created a skill hierarchy for each participant, individualized to the participant’s performance block skill. The researcher provided the rationale to the gymnasts, which explained that the gymnasts worked on drills they could easily perform successfully, and that the different drills slowly led up to the performance block skill. Each drill more closely resembled the skill about which the gymnast had the performance block. The final step (e.g., step 10) was the complete skill about which the participant has the performance block. The gymnast completed the drill at
each step in the hierarchy at least three times successfully with a rating scale score of 2 to move onto the next step in the skill hierarchy. When the gymnast stated they were ready, the researcher prompted them to say their positive thoughts out loud. After the gymnast stated their positive thoughts, the researcher prompted the skill (e.g., “set and jump to a flat back on the resi” [first skill in the hierarchy]). The researcher provided at least 10 s of attention if the gymnast initiated and completed the skill correctly and immediately. The attention included praise, a high-five, cheering, etc. For example, the researcher may have said “great job” while clapping and cheering. If the gymnast did not initiate the skill, initiated the skill but failed to land the skill, or executed a different skill, the researcher stated what the gymnast did (e.g., “okay, you set”) but did not provide any additional attention. Successful performance resulted in praise and unsuccessful performance resulted in repeating the process. The gymnast must have successfully completed the skill/drill (scored a 2 on the rating scale) for at least three consecutive trials to move onto the next step in the hierarchy.

**Incentives.** Incentives were used for Kayla and Cassie as an additional intervention component. Candy was used as a reinforcer for Kayla. Each time Kayla caught the bar, the implementer let the participant pick one piece of candy and place it inside a jar. Each time the participant missed the bar the implementer took one piece of candy out of the jar (the participant did not get to pick) and the implementer started the next trial at the previous step in the skill hierarchy. When the participant caught the bar for three consecutive trials, the implementer began the next step in the skill hierarchy and rewarded the participant with three pieces of candy. When the participant caught the bar three consecutive times on the last step of the entire hierarchy, the implementer delivered the entire bag of candy to Kayla. Time with the researcher was also used as an incentive. Beginning trial 174, once the participant did not catch the bar two
times total, the session ended. Preferred gymnastics skills were used as an incentive for Cassie. Each time Cassie successfully completed a step for three consecutive trials, she was able to perform preferred skills on the tumble track while the researcher set up the next step.

**Post-training**

The post-training condition was conducted as baseline with no intervention components. The researcher did not provide feedback if the gymnast initiated the skill, but failed to land the skill, executed a different skill, or did not initiate the skill within the 3-min time cap. The researcher prompted the gymnast to perform the skill at least three consecutive times. The researcher thanked the gymnast for their participation but did not provide any feedback related to the skill. The coach was located in the same position as in intervention.

**Follow-up**

The follow-up condition was conducted one week after the last gradual exposure session and was conducted as post-training. The researcher thanked the participants for their participation but did not provide any feedback.
CHAPTER THREE: RESULTS

Figure 1 displays the rating scale performance results of the study. All three participants increased their rating scale scores on their performance block skill from baseline to the post-treatment and follow-up. None of the participants initiated and completed the skill successfully in baseline and all three participants initiated and completed the skill successfully in the post-treatment and follow-up conditions. The duration of the study was 22 sessions and 196 trials over four months for Kayla, 11 sessions and 193 trials over one month and 11 days for Cassie, and seven sessions and 88 trials over three weeks for Caitlyn.

Kayla scored a 1 on the scale for all baseline trials. She jumped from the low bar to the high bar, and either would not touch the high bar at all or would tap the bar and let go. Kayla successfully initiated and completed the jump to the high bar in the post-treatment and follow-up conditions. Modifications were made throughout the intervention condition. Kayla was inconsistent with completing the skill throughout the hierarchy and required several regressions before advancing to step 8. At step 8, Kayla consistently completed the skill within a few trials. The first modification for Kayla included the addition of a candy incentive. This modification was introduced in trial 122. This modification helped her from step 7 through step 12. The second modification, introduced on trial 174, included limiting her attempts to only two per session. The use of both modifications resulted in Kayla overcoming her performance block and performing the skill.
For eight out of nine trials in baseline, Cassie scored a 1; she initiated the skill, but failed to complete the skill successfully. Specifically for Cassie, this meant that she completed the round off and back handspring but failed to connect them without a pause. She scored a 0 on the rating scale for one of the nine baseline trials. Cassie did the round off but failed to initiate the back handspring. In the post-treatment, she completed each trial successfully—she connected the round off back handspring without a pause. Similar to Kayla, Cassie experienced several regressions before advancing through the hierarchy. When Cassie regressed from step 7 to step 2, the researchers added an incentive: time with preferred skills contingent on successful performance. After adding the incentive, Cassie progressed through the hierarchy without any other additional modifications.

Caitlyn scored a 0 on the rating scale for every trial in baseline. Each time the researcher prompted her to do a back handspring she responded with a verbal “no.” Caitlyn’s skill hierarchy consisted of eight steps. Caitlyn completed the entire hierarchy during intervention, but when the researcher conducted the first post-treatment, she failed to initiate the back handspring for each trial. Therefore, Caitlyn repeated steps six, seven, and eight during the next session. The following session took place a week later, so the researchers decided to repeat steps six, seven, and eight before implementing the post-treatment. The post-treatment took place the day following the completion of the hierarchy. During this second post-treatment, Caitlyn successfully initiated and completed the back handspring for all trials. She also successfully initiated and completed the back handspring during all trials during the follow up session.

The SUDS score decreased for each participant from baseline to the post-treatment and follow-up conditions. Kayla SUDS score was an average of 4.33 (4-5) during baseline, 0 during post-treatment, and 0 during follow-up. Cassie’s SUDS score was an average of 0.94 (0 - 4)
during baseline, and 0 during post-treatment and 0.2 during (0 - 1) follow-up. Caitlyn’s SUDS score was an average of 5.75 (1-10) during baseline, and 0 during post-treatment and 0.67 (0-2) during follow-up. The decrease in SUDS score indicates a decrease in anxiety levels as participants worked through the hierarchy toward their goal performance.

The average latency to initiate their performance block skill decreased for each participant from baseline to the post-treatment and follow-up conditions for all three participants. Kayla’s average latency was 14 s (11 s – 18 s) in baseline, 11 s (10 s – 12 s) during post-treatment, and 6.71 s (5.95 s – 7.18 s) during follow-up. Cassie’s average latency was 9.11 s (2 s – 60 s) in baseline, and 3.2 s (3 s – 4 s) during post-treatment, and 5 s (3 s – 10 s) during follow-up. Caitlyn’s average latency was 60 s (never initiated) in baseline, 2 s (1 s – 3 s) during post-treatment and 2s (1 s – 3 s) during follow-up.

The SAS-2 scores for each participant decreased from baseline to after intervention. Kayla scored a 10 on somatic symptoms, 7 on worry symptoms, and 6 on concentration disruption for a total score of 23/60 in baseline. She scored a 5 on somatic symptoms, a 5 on worry symptoms, and a 5 on concentration disruption for a total score of 15/60 in post treatment. Cassie scored a 17 on somatic symptoms, a 15 on worry symptoms, and a 12 on concentration disruption for a total of 44/60 in baseline and a 7 on somatic symptoms, a 6 on worry symptoms, and a 7 on concentration disruption for a total of 20/60 in post treatment. Caitlyn scored an 11 on somatic symptoms, a 14 on worry symptoms, and a 16 on concentration disruption for a total of 41/60 in baseline. She scored an 8 on somatic symptoms, 9 on worry symptoms, and 7 on concentration disruption for a total of 24/60 in post treatment. All three participants had a decrease in somatic, worry, and concentration disruption from baseline to post intervention.
CHAPTER FOUR: DISCUSSION

The purpose of this study was to evaluate a behavioral intervention consisting of progression through a gradual exposure hierarchy and thought training to decrease performance blocks in gymnastics. Gradual exposure was used by creating a skill hierarchy individualized to each participant’s performance block skill. Each step in the skill hierarchy more closely resembled the performance block skill. Thought training, based on REBT (DiGuisepppe & David, 2015), included the gymnast developing positive thoughts that replaced their negative thoughts relating to the performance block skill. All three participants decreased their performance blocks. Gradual exposure is a behavioral intervention commonly used to treat fears (Grider et al., 2012; Miltenberger, 2016; Sherman 1972). Performance blocks have been studied in sport psychology using interventions such as EMDR with graded exposure, PST, and stress inoculation training. However, this study was the first to evaluate performance blocks using an objective measure of performance to evaluate the effects of the intervention. Although not an initial purpose of the study, an added purpose was to evaluate the addition of tangible reinforcement with gradual exposure and thought training. The results suggests this addition may be important for success.

Because we used a combination intervention consisting of gradual exposure and thought training, it is not clear how much the individual intervention components contributed to the improvements in performance. Because little research has been conducted on managing performance blocks and even less using objective measures, we chose to investigate a package intervention to achieve the greatest effect. Further research can investigate the relative
contributions of the individual components. Furthermore, because we added a tangible reinforcement condition to the intervention for two of the three participants, it is even less clear what the critical ingredients of an effective intervention should be. Although tangible reinforcement worked when added to the other two procedures, it is not clear if tangible reinforcement would have worked independent of the other two procedures. Our recommendation would be to include tangible reinforcement in a gradual exposure and thought training intervention to achieve maximum benefits. Future research could then investigate the contributions of each intervention component.

As observed in Kayla’s data, the anticipation of competing in a gymnastics meet may have affected her performance block skill. During the sessions prior to a competition, Kayla often commented on how important it was to master the skill for the competition and seemed to work harder toward improvement. However, even when she made great progress within a session such as trials 44 through 69 (the week prior to her mock meet), she stated that she was disappointed in herself since she did not complete the skill that day. During these three sessions, Kayla progressed from step 3 to step 6. Even though the researcher pointed out how far she had made it through the hierarchy within each session and to take it one step at a time, the proximity to a meet seemed to have affected her self-talk and potentially her motivation. Following the addition of candy as a tangible reinforcer, Kayla made great progress. However, when her progress stalled again, the researchers speculated that the added attention associated with the added trials that followed failed trials may have inadvertently reinforced her failure to complete the trials. Therefore, we made the modification in which we ended a session after two failed trials. In this way, further attention was not contingent on failed attempts. Instead, completing
trials successfully resulted in increased attention and interaction. With this final change in the intervention, she achieved success throughout post training and follow-up sessions.

Cassie had a pattern of progression and regression in her data. She progressed through step 7 within the first two sessions. She then regressed back to step 2 in the following three sessions. We speculate that a few potential factors could have affected the quickness with which she progressed and regressed. The novelty of the gym and researcher could have influenced the quick progress within the first few sessions due to the change in environment. We speculate that she experienced aversive or stressful stimuli such as pressure from coaches, reprimands, and/or the history of negative reinforcement in her previous gym and the move to a new gym brought relief from these aversive stimuli. Additionally, it may have been reinforcing for the gymnast to complete the skill successfully to receive praise from novel individuals in her new gym. External events such as the gymnast switching gyms the week prior to the regression sessions could have affected her progress. Although entering the novel gym may have relieved the gymnast from aversive stimuli associated with her prior gym, it is probable that the gymnast encountered stressful stimuli associated with entering a new gym and saying goodbye to her prior teammates. It is possible that these events could have increased the variety of negative thoughts experienced by the gymnast. Future research should take note of these and other external factors and observe their potential effect on performance blocks. Additionally, during this week between sessions, Cassie performed in a play and this event was followed by a regression. We believe it is important to assess external stressors such as these when working with gymnasts for whom performance blocks are a problem. Because performance blocks likely have an anxiety component, any factors that might increase a gymnast’s stress or anxiety could influence their performance block skills.
It is important to note that a performance block may be maintained by a history of negative reinforcement. By refusing to do the skill or completing a different skill, the participants may escape the aversiveness of the fear or anxiety that corresponds with completing the skill. Cassie, for example, may have been escaping the physiological sensations that occurred when she connected the round off and back handspring without a pause. These physiological sensations include the somatic symptoms of anxiety such as muscle tension and stomach tension, shaky muscles, and upset stomach (Smith et al., 2006). Therefore, the history of negative reinforcement may be an additional factor in the severity of performance block. Because they were older, Kayla and Cassie (both age 11) may have had a much greater history of negative reinforcement relating to their performance block skill, therefore, making it more difficult to break the habit of not performing the skill. Caitlyn (age 7) had shorter a history of escaping this fear. This may be a reason why additional incentives were needed for Kayla and Cassie, but not for Caitlyn, to compete with the reinforcement obtained by escape. For Cassie, the opportunity to engage in preferred skills competed with escape. Whereas, with Kayla receipt of tangible items such as candy and time with the researcher for completing hierarchy steps successfully competed with escape. It is interesting to note the low SUDS scores for Kayla and Cassie in baseline. This may be a result of them avoiding the discomfort associated with performing the performance block skill.

Although all three participants had a decrease in their performance block, the study was not without limitations. The intervention took approximately 4 months for Kayla (three 30-min sessions a week) and 1 month for Cassie and Caitlyn (two 1-hr sessions per week). Therefore, a limitation is the variability in the duration of the study. Another limitation is the lack of control over external events such as competitions and other life stressors. Additionally, the researcher
did not tell the participants not to practice their performance block skill at their gymnastics practices. This did not seem to influence the progress made within sessions; however, the participants may have had additional negative reinforcement maintaining their performance block if they refused to perform the skill or did not complete the skill when practicing their skill outside of the study.

Future research should attempt to replicate this study by evaluating gradual exposure, thought training, and tangible reinforcement with other gymnasts struggling with performance blocks. Future researchers should also evaluate these behavioral interventions with other types of performance blocks such as the yips in golf (Bennett et al., 2015). After establishing the robustness and generality of the intervention package, it would also be interesting to evaluate the relative contributions of thought training, gradual exposure, and tangible reinforcement to understand the critical ingredients of the intervention, understand the basic principles involved in the successful intervention, and possibly simplify the intervention.
Figure 1

Rating Scale Score of Performance Block Skill across Gradual Exposure and Thought Training Treatment Package.

Note. This figure displays the rating scale scores for the gymnasts in baseline, the gradual exposure procedure, and follow-up. The last skill listed in the gradual exposure sequence is the performance block skill (e.g., step 10). 0 = refusal, 1 = the participant initiated the skill but failed to complete it successfully, 2 = the participant initiated the skill and completed it successfully. PU= post-treatment, FU= follow-up.
REFERENCES


https://doi.org/10.1080/21520704.2016.1235649

Howells, K. (2017). *Butterflies, magic carpets, and scary wild animals: an intervention with a young gymnast* [Unpublished manuscript]. The Open University, United Kingdom.  
*Butterflies, Magic Carpets, and Scary Wild Animals - An Intervention with a Young Gymnast.pdf (cardiffmet.ac.uk)*

https://doi.org/10.1123/jcsp.2018-0101

http://dx.doi.org/10.1136/bjsm.20.3.139

https://hrcak.srce.hr/file/96939


APPENDICES
Appendix A: Data Sheet

<table>
<thead>
<tr>
<th>Trial # /date /initials</th>
<th>Step #</th>
<th>Latency (s)</th>
<th>Rating Score (circle)</th>
<th>SUDS Score</th>
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<td></td>
<td></td>
<td></td>
<td>0 1 2</td>
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<td></td>
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<td></td>
<td>0 1 2</td>
<td></td>
</tr>
</tbody>
</table>

1: The participant does not initiate the skill. (*Note: participant two does not initiate the back handspring).
2: The participant initiates the skill but fails to complete it successfully. (*Note: participant two does the round off and back handspring but fails to connect them without a pause).
3: The participant initiates the skill and completes it successfully. (*Note: participant two connects the round off and back handspring without a pause).

**Latency P2:** from the moment the researcher FINISHES saying “do a round off back handspring” to the moment her feet come off the floor in the back handspring, NOT the round off.

**Muscle Tension:** the visual contraction of muscles such as closure of palms in a fist-like manner, facial expressions (e.g., forehead wrinkles, scrunched nose, etc.), shoulders raised towards ears, flexed biceps, and other observable behaviors.

Appendix B: SAS-2

[https://doi.org/10.1123/jsep.28.4.479](https://doi.org/10.1123/jsep.28.4.479)
**Appendix C: Treatment Integrity**

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</thead>
<tbody>
<tr>
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<td>Trial 1</td>
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<tr>
<td>Did the researcher provide the gymnast with the explanation, “Each time you initiate the skill, you will get a short break before being given the prompt again.”</td>
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</tr>
<tr>
<td>Did the researcher explain to the gymnast the connection between the positive thoughts and the consequences?</td>
<td></td>
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<tr>
<td>Did the researcher conduct the thought training procedure (e.g., repeat your positive thoughts aloud for 15s or 5 times)?</td>
<td></td>
</tr>
<tr>
<td>Did the researcher prompt the gymnast to execute the appropriate skill (e.g., “jump to the high bar”)?</td>
<td></td>
</tr>
<tr>
<td>Did the researcher ask the gymnast for her SUDs rating immediately after the gymnast finished the required skill in the first trial of the skill in the skill chain?</td>
<td></td>
</tr>
<tr>
<td>Did the researcher praise the gymnast for completing the skill correctly and immediately?</td>
<td></td>
</tr>
<tr>
<td>If the gymnast did not initiate the skill, or initiated the skill but failed to land the skill, or executed a different skill, did the researcher state what the gymnast did (e.g., “okay, you did a back walkover”) but did not provide attention (e.g., “thank you for trying a back walkover instead of the back handspring”)?</td>
<td></td>
</tr>
<tr>
<td>Did the researcher wait until the 1-min cap to give the gymnast a break before providing the prompt again if the gymnast did not initiate the skill?</td>
<td></td>
</tr>
<tr>
<td>Did the researcher provide a break before repeating the prompt after the gymnast initiated the skill, but failed to land the skill, or executed a different skill?</td>
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</table>
## Appendix D: Social Validity Questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree (1)</th>
<th>Agree (2)</th>
<th>Neutral (3)</th>
<th>Disagree (4)</th>
<th>Strongly Disagree (5)</th>
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</thead>
<tbody>
<tr>
<td>1. The procedures were beneficial.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>2. The gymnasts’ performance blocks decreased.</td>
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<tr>
<td>3. This study took too much time.</td>
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<tr>
<td>4. I am likely to implement these procedures in the future to help other gymnasts with performance blocks.</td>
<td></td>
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<tr>
<td>5. I would recommend this intervention to other coaches or gymnasts.</td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>
Appendix E: Gymnasts’ Interview Questions

1. Please describe your performance block.

2. What skill does it occur on?

3. Why do you think you have a performance block?

4. Did something happen to trigger the performance block?

5. What goes through your head when you are about to attempt the skill?

6. What goes through your head when you are about to attempt a skill without a performance block?

7. How do your coaches usually respond if you take a while to perform the skill or refuse to do the skill?

8. What do you think is most helpful when working on the skill about which you have the performance block?

9. What do you think is the least helpful?

10. What is the closest version of the skill you will attempt? Will you attempt the skill with a spot? Will you do the skill on the trampoline?

Appendix F: Coaches’ Interview Questions

1. What does the performance block look like?

2. Does the gymnast talk about the performance block? If so, what do they say?

3. Does the gymnast try to abort the skill (bail out), change the skill, refuse to do it?

4. How does the gymnast react after you tell the gymnast to do the skill?

5. What methods have you attempted to help the gymnast with the performance block? Which methods do you think are the most effective?

6. Why do you think the gymnast is struggling with the performance block?
Appendix G: Gradual Exposure Hierarchies

Backhand spring on Tumble Track

Step 1: Back limber on 8-inch mat on tumble track.

Step 2: 8-inch mat back handspring on tumble track (no spot).

Step 3: 4-inch mat back handspring on tumble track (light spot).

Step 4: 4-inch mat back handspring on tumble track (no spot).

Step 5: Sting mat back handspring on tumble track (light spot).

Step 6: Sting mat back handspring on tumble track (no spot).

Step 7: Back handspring on tumble track (light spot).

Step 8: Back handspring on tumble track.
Round Off Back Handspring

**Step 1:** Round-off off tumble track (hands on tumble track, feet off tumble track), rebound flat back onto resi mat.

**Step 2:** Roundoff back handspring off tumble track.

**Step 3:** Roundoff back handspring off tumble track with a difference in height.

**Step 4:** Roundoff off panel mats, land on wedge, back handspring down.

**Step 5:** Handstand whip down back handspring on mini trampoline.

**Step 6:** Stacked panel mats, round-off onto 8-inch mat, back handspring on 8-inch mat.

**Step 7:** Roundoff on panel mats back handspring off on blue mat.

**Step 8:** Roundoff on panel mats back handspring off on sting mat.

**Step 9:** Roundoff on panel mats back handspring off, no mat.

**Step 10:** Lower panel mats, roundoff back handspring off, no mat.

**Step 11:** Roundoff back handspring.
Jump to High Bar

Step 1: small set bars, 8-inch mat, two red bocks, blue block on top of red blocks, 8-inch mat on top.

Step 2: small set bars, two red blocks, blue block on top of red blocks, 8-inch mat on top.

Step 3: small set bars, two red blocks, panel mat on top of red blocks, 8-inch mat on top.

Step 4: small set bars, two red blocks sideways, panel mat on top, 8-inch mat on top.

Step 5: small set bars, two red blocks sideways, 8-inch mat on top.

Step 6: small set bars, two 8-inch mats.

Step 7: small set bars.

Step 8: wide set bars, jump from red block.

Step 9: wide set bars, jump from blue block on top of red block.

Step 10: wide set bars, jump from small panel mat on top of the blue block on top of the red block.

Step 11: wide set bars, jump from small panel mat on top of the blue block on top of the red block, calves touch the bar.

Step 12: wide set bars, jump from two small, stacked panel mats on top of the blue block on top of the red block, heels touch the bar.

Step 13: wide set bars, two stacked panel mats on top of the blue block on top of the red block (under the low bar), jump from bar.

Step 14: wide set bars, blue block on top of red block (under the low bar), jump from bar.

Step 15: wide set bars, jump to high bar.
Appendix H: IRB Letter of Approval

October 17, 2022

Cara Shapiro

Dear Cara Shapiro:

On 10/17/2022, the IRB reviewed and approved the following protocol:

<table>
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<th>Initial Study</th>
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<tr>
<td>IRB ID:</td>
<td>STUDY004822</td>
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<tr>
<td>Review Type:</td>
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<tr>
<td>Title:</td>
<td>Evaluating a Behavioral Intervention for Performance Blocks in Gymnastics</td>
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<td>Funding:</td>
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Approved Protocol and Consent(s)/Assent(s):

- Cara- IRB Protocol IRB Clean1.docx;
- Cara Shapiro- Social Behavioral Assent IRB Review Clean.pdf;
- Cara- Social Behavioral Combined Consent and Parental Permission IRB Review Clean.pdf;
- HRP-502b Social-Behavioral Adult Consent- coaches__IRB Review Clean.pdf;

Approved study documents can be found under the ‘Documents’ tab in the main study workspace. Use the stamped consent found under the ‘Last Finalized’ column under the ‘Documents’ tab.

Within 30 days of the anniversary date of study approval, confirm your research is ongoing by clicking Confirm Ongoing Research in BullsIRB, or if your research is complete, submit a study closure request in BullsIRB by clicking Create Modification/CR.
In conducting this protocol you are required to follow the requirements listed in the INVESTIGATOR MANUAL (HRP-103).

Research Involving Children as Subjects: 45 CFR 46.404
This research involving children as participants was approved under 45 CFR 46.404: Research not involving greater than minimal risk to children is presented.

Requirements for Assent and/or Permission by Parents or Guardians: 45 CFR 46.408
Permission of one parent is sufficient.

Assent is required of all children.

Sincerely,

Shanitra Butler
IRB Research Compliance Administrator