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Training sessions developing mental skills that athletes can use during competition are often conducted in workshop settings, limiting opportunities for athletes to apply and transfer the skills into performance (Hamilton et al., 2020). Developing a training method that integrates mental skills in the performance environment can provide the necessary context for athletes to learn, retain, and transfer mental skills into competition to facilitate optimal performance (Hamilton et al., 2020). Training environments designed from a constraints-led approach, where coaches influence the training environment to produce context-relevant information, have been shown to facilitate physical skill development (Reid et al., 2007; Araújo et al., 2013), but limited applied research has been conducted demonstrating the usefulness of this approach in the development of mental skills. As such, the purpose of this study was to evaluate the effectiveness of a constraints-led mental skills intervention. An 8-session constraints-led mental training program for youth basketball players was evaluated using pre- and post-program surveys, post-session surveys, and a final program evaluation. Results from 26 youth basketball players ranging in age from 15-18 (M = 16.58) demonstrated development for relaxation (p = .017) and focus (p = .019) in practice, but not in games. There was no significant impact on self-talk skills and no significant differences in reported skill usage. Participants reported that they generally enjoyed the program and valued the on-court experience in helping them learn and practice mental skills. Overall, findings are promising and suggest that a constraints-led mental training program may be a potentially effective program for facilitating the development of mental skills. Findings from this study can provide a model for how MPCs can create effective mental training programs in an environmental context that will facilitate mental skills for optimal performance.

TRAIN YOUR BRAIN THE WAY YOU PLAY:

A CONSTRAINTS-LED APPROACH

TO DEVELOPING MENTAL

SKILLS IN SPORT

by

Lindsey Hamilton

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Approved by

Dr. Erin J. Reifsteck
Committee Co-Chair

Dr. Louisa D. Raisbeck
Committee Co-Chair

APPROVAL PAGE

This dissertation written by Lindsey Hamilton has been approved by the following committee of the Faculty of The Graduate School at The University of North Carolina at Greensboro.

Committee Co-Chair

Dr. Erin J. Reifsteck

Committee Co-Chair

Dr. Louisa D. Raisbeck

Committee Member

Dr. Diane L. Gill

June 22, 2023

Date of Acceptance by Committee

April 3, 2023

Date of Final Oral Examination

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CHAPTER I: PROJECT OVERVIEW

The ability to focus the mind to perform at an optimal level is paramount to athletic success (Swann et al., 2016). As such, mental training has gained significant interest in the athletic arena to develop mental skills and strategies that athletes can learn and use to facilitate successful performance (Gould et al., 2002; Hanton & Neil, 2019). To learn these skills effectively, athletes must retain previously learned psychological skills and know how to transfer those skills into their performance environments (Magill, 2016). The transfer of skills across domains or different performance contexts is most successful when the individual understands how to interact with the environment and the task (Pinder at al., 2011). This approach has been explained using Newell's ecological approach to acquiring skills through a constraints-led approach (Newell, 1986). Although this training paradigm has been consistently applied to physical training, its application to mental training is often overlooked. Mental Performance Consultants (MPCs) are tasked with improving the transferability of mental training into the competitive environment so that athletes can apply and use mental skills to enhance optimal performance. However, mental training sessions are often conducted in a classroom or workshop setting – both of which are very unlike the setting to which the psychological skills need to be transferred (Hamilton et al., 2020). Not only does this limit the opportunities for athletes to apply the mental skills, but it also makes acquiring skills difficult because it impedes the transfer and retention stages of the learning process (Magill, 2016). Thus, developing a training method that situates mental skills in the performance environment can provide the necessary context for athletes to learn, retain, and transfer mental skills into competition to facilitate optimal performance.

Review of Relevant Literature

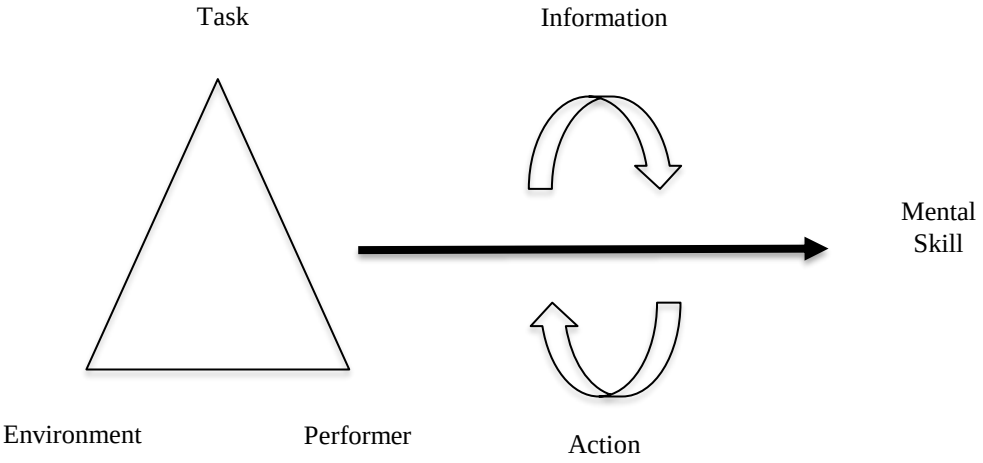
Mental Performance Consultants (MPCs) are tasked with cultivating an effective psychological state (i.e., cognitions and affect) in athletes to aid them in reaching the best chances of success in performance. While the optimal psychological state will be dependent on factors such as the individual performer, the unique objectives and demands of the sport, and the context of the sporting environment, systematic mental skills training can enhance an athlete's ability to perform at the highest levels while accounting for these factors (Gould et al., 2002). In most cases, this training includes delivering psychoeducation to athletes with the intention of applying this information during competition (Hanton & Niel, 2019). To learn these skills effectively, athletes must be able to both retain the psychological skills they were educated on and transfer those skills into their performance environments (Magill, 2016).

One possible framework for improving transfer of mental skills into the performance environment is through representative learning design (Pinder, et al., 2011). Representative learning design refers to the degree to which the training environment reflects the performance environment (Pinder, et al., 2011). Training environments that mirror the demands of competition afford performers an opportunity to learn and transfer skills from practice to competition relatively consistently (Davids et al., 2013). While representative learning design is a concept that has informed learning in many sport contexts (Gorman & Maloney, 2016; Guignard et al., 2020; Reid et al., 2007), closer representation of practice environments to competition environments requires that practice be designed through the lens of athlete cognitions (i.e., judgments or decision-making; Dhami et al., 2004; Renshaw et al., 2019) or affect (emotions or feelings; American Psychological Association, 2021; Headrick et al., 2015; van Kleef et al., 2019). A lack of cognitive and affective representativeness in training compared

to competition negatively impacts skill transfer to the competitive environment (Maloney et al., 2018).

Previous research has sought to incorporate these psychological aspects into practice settings through stress induction (Oudejans & Pijpers, 2010) or pressure training (Low et al., 2021); however, limited research to date has systematically leveraged representative learning design in the practice context to facilitate the development of targeted mental skills to handle those psychological demands. One theory that may be applied to designing representative learning environments to train mental skills is Newell's (1986) Model of Interacting Constraints (Figure 1; Hamilton et al., 2020). Newell's model of constraints depends on the interaction between the individual, the task and the environment. According to Newell's model, skill development occurs when a more functional relationship between the environment and the performer is achieved. This relationship is determined based on a set of constraints, or features, that are manipulated to influence movement and skill expression. These constraints typically fall into one of three categories: task, performer, or environment (Newell, 1986). Task constraints are those that are associated with the objective of the activity or the equipment necessary or accessible for the task (Newell, 1986). Performer constraints pertain to the individual performers themselves, and can include physiological (e.g., fatigue), biological (e.g., male or female), cognitive (e.g., thoughts), emotional (e.g., anxiety or excitement), or cultural factors. Environmental constraints include physical factors, such as the playing surface, or social factors like spectators.

Figure 1. Newell's Model of Interacting Constraints.



Note. Newell's model of interacting constraints adapted to illustrate the resulting effects on mental skill development. Adapted from Davids, K., Glazier, P., Araújo, D., & Bartlett, R. (2003). Movement systems as dynamical systems: The functional role of variability and its implications for sports medicine. *Sports Medicine, 33*(4), 245-260.

Rooted in ecological psychology, Newell's (1986) model emphasizes the organism-environment as one unit of study through which perception and action are continually evolving, creating affordances within the environment (Heft, 2013; Lobo et al., 2018). Approaching the learning environment from an ecological perspective prioritizes the environment as a significant contributor to behavior, while simultaneously rejecting the previously held behaviorism notion that the person is only a passive vessel of perception (Lobo et al., 2018). This ecological approach to learning and development emphasizes that an organism perceives necessary information from its surroundings to plan and execute tasks in a particular environment (Kugler & Turvey, 1987). For example, a soccer coach might modify the size of the field, equipment used, and rules of play to provide affordances for the athletes to interact with the environment in a manner that encourages success with the task. These modifications change over time, with experience, success, and interaction. When the task or equipment are modified,

research has shown that skill development can occur at a faster rate, reinforcing the value of representative learning environments. An ecological approach also considers the individual accounting for perception, emotions, and actions that are both internal and external to the performer (Seifert & Davids, 2012). As such, it is imperative that coaches understand how to manipulate training environments and internal experiences to couple perceptual and action information together to produce desired skills in particular competitive settings.

While Newell's Model of Interacting Constraints (1986) was originally applied to a variety of motor learning tasks like drawing (van Emmerik & Newell, 1990), basic throwing (McDonald et al., 1989), and postural dynamics (Slobounov & Newell, 1994), the applicability of the model evolved toward enhancing skill development more generally. Most recently, Hamilton et al. (2020) asserts the theory as a possible guide for how to develop mental skills as well since the psychological representativeness of the environment can also play a role in facilitating effective training to foster more effective skill development and performance (Maloney et al., 2018; McCosker et al., 2019; Oudejans & Pijpers, 2010).

Coaches have benefitted from manipulating constraints to create a context that couples environmental information with action in such a way that produces a desired skill and serves as a tool to facilitate representative learning environments (Hamilton et al., 2020). This has been demonstrated in performance settings such as tennis (Reid et al., 2007), cricket (Renshaw et al., 2010), and soccer (Araújo et al., 2013), among others. These findings have added to the clear evidence that constraints-led environments both assist in creating representative practice contexts as well as effectively facilitate skill development. The need then becomes equipping the athlete with the mental skills necessary to succeed in the ever-evolving environment.

As apparent in the previously identified research, constraints-led examinations have predominantly focused on movement skills as the primary goal. However, more recent research suggests that establishing a reliable foundation of skilled performance is highly dependent on knowledge grounded in athlete intentions and cognitions (Renshaw et al., 2019). McCosker et al. (2019) considered the psychological influence of intentions and decision-making in performance of elite long jumpers. Specifically, the authors examined how athletes' jump intention was impacted based on current placing and previous performance, wind, and rules of the sport. Results indicated that jump behaviors should not be viewed as isolated events, but instead as part of a larger, interconnected performance where environmental, task, and individual constraints affect outcomes. These interactions were not accounted for in training, resulting in a less representative training environment and possibly underpreparing athletes for the adaptability and decision-making required in competition.

In a more experimental design study, Maloney et al. (2018) explored how cognitions and affect differed between training and competitive environments for Taekwondo athletes, and if this difference impacted performance behaviors. Taekwondo athletes specifically indicated that the less intense mental demands of training did not afford athletes the opportunity to practice the decision-making necessary to succeed against unpredictable opponent movements in competition, and that their inconsistent positioning negatively impacted execution of the kicking skill used in performance. This study provides evidence to suggest that low cognitive and affective representation in training is associated with dissimilar performance behaviors, suggesting implications for practice design, skill development, and performance enhancement.

Whereas Maloney et al. (2018) examined cognitive and affective demand differences between training and competition on performance behaviors, Oudejans and Pijpers (2010)

examined how psychological demands in training impacted overall performance states in competition. Using a dart-throwing exercise, the authors found that training with mild levels of anxiety helped to maintain dart-throwing performance in high anxiety posttests, compared to a low-anxiety level training which resulted in a decrement in performance. Not only do the results of this study suggest that psychological states of the individual impact dart-throwing performance, but also that inducing these psychological states into training can prove beneficial for performance in similar competition settings. However, representative practices designed to develop mental skills are lacking.

Hamilton et al. (2020) offered an outline for how to apply a constraints-led approach to the psychological aspects of sport to enhance the representativeness of training environments, incorporate the psychological demands of performance, and facilitate mental skill development. In their example, a constraints-led approach was used to manage anxiety in a hitting task in baseball, through three steps based on the constraints led paradigm. Although this article systematically describes a process for applying a constraints-led approach to meet the psychological demands of a sporting context, it is only a proposed application within a theoretical framework. While it is understood that conducting mental skills interventions inside the athletes' performance arena would maximize the impact on the athlete or team (Larsen et al., 2014), currently, research executing a constraints-led mental training intervention to develop mental skills is lacking.

Purpose

Given the impact of ecological psychology, representative learning design, and constraints-based coaching as a methodology through which to enhance skill development, there is an opportunity to apply these principles to develop mental skills systematically. Thus, the

purpose of this study was to evaluate a constraints-led mental training program designed to facilitate the development and use of mental skills. It was hypothesized that participating in an 8-session mental skills training program that applied the constraints-led approach would improve youth basketball players' mental skill proficiency and increase their use of these skills in practice and games.

Methods

To address the purpose of this study, a constraints-led mental skills training intervention was evaluated. An 8-session training intervention, including a pre/post assessment approach was employed, and post-session questions were used to measure perceptions of the intervention. This study was approved by the university's IRB, with permission from the mental skills training site, to evaluate de-identified data collected from this intervention.

Participants and Procedures

Forty-four competitive youth basketball players at a training academy participated in the intervention in the fall season and fully completed the pre- and post-intervention questionnaires. In order to account for variability in age, gender, years of experience playing organized basketball, and years of experience in mental training, a purposive sub-sample was taken from this larger pool of youth basketball players (Babbie, 2016). The sub-sample drawn from this data set for the analyses presented here is focused on 26 youth female basketball players. Table 1 describes the participant demographics in detail.

Table 1. Participant Demographics

Category	Frequency	Percent
Race		
American Indian or Alaska Native	1	4%
Asian	2	8%
Black or African American	3	12%
Hispanic or Latino	2	8%
White/Caucasian	10	38%
Multiracial	6	23%
Other	1	4%
Prefer not to answer	1	4%
Years of experience playing organized basketball		
First season of organized basketball	0	0%
1-2 seasons of organized basketball	1	4%
3-4 seasons of organized basketball	4	15%
5-6 seasons of organized basketball	3	12%
More than 6 seasons of organized basketball	18	69%
Average hours spent playing basketball per week		
0 – 2 hours	0	0%
2.01 – 5 hours	1	4%
5.01 – 8 hours	1	4%
8.01 – 11 hours	4	15%
11.01 – 14 hours	7	27%
More than 14 hours	13	50%
Years of experience in mental training		
This is my first season of mental training	14	54%
1-2 seasons of mental training	6	23%
3-4 seasons of mental training	5	19%
5-6 seasons of mental training	0	0%
More than 6 seasons of mental training	1	4%

Prior to the start of the intervention, demographic information was collected, and participants completed pre-intervention assessments to measure baseline mental skill proficiency and use. Participants completed the assessments electronically on personal devices or via pen and paper.

The primary investigator, a Certified Mental Performance Consultant (CMPC) via the Association of Applied Sport Psychology, implemented the 8-session intervention over 15 weeks. The sessions followed the intervention instructions in Appendix F. Following each session, participants completed two post-session questions to assess if the intervention was implemented as intended. Upon completion of the intervention, participants completed a post-intervention assessment to determine changes in mental skill proficiency and use in practice and games. The participants also completed a program evaluation ratings to provide feedback on the their experiences with the intervention.

Intervention

The intervention was designed from a constraints-led approach, taking into consideration the psychological demands of basketball, and particularly emphasizing development of the mental skills self-talk, relaxation breathing, and focus cues. The mental training program was developed following the step-by-step process outlined by Hamilton et al. (2020) and in collaboration with an experienced basketball coach and CMPC. The program consisted of eight sessions with an emphasis on task, environmental, or performer constraints that elicit psychological experiences that mirror competitive basketball situations. The sessions occurred over the course of 15 weeks, were conducted on a basketball court in a practice environment, and each lasted 30 minutes. A detailed overview of the instructions and focus of each session can be reviewed in Appendix F. The following outlines a summary of the intervention:

Pre-Intervention Session

Participants engaged in a welcome meeting at the beginning of the pre-season, where they were introduced to the mental performance coach, each other, and more about what mental training is, what it looks like, and how they can make use of it.

Session 1

This session introduced players to the mental demands in the practice environment. The practical on-court exercise manipulated task constraints to elicit focus and emotional demands so that players could see how their mindset impacts performance.

Session 2

This session introduced focus under pressure. The practical on-court exercise manipulated task constraints and was designed to elicit various external distractions to challenge player focus. Physical cues were constrained to help players regain their focus.

Session 3

This session reinforced focus under pressure. The practical on-court exercise manipulated task constraints and was designed to build on the external distractions from the previous week and challenge players to reset their focus. Use of physical cues were constrained to demand continuous repetition of the skill.

Session 4

This session introduced time constraints and competition. The practical on-court exercise manipulated performer and task constraints and was designed to elicit a stress response that could interfere with performance. Relaxation breathing was constrained to help players regain their composure.

Session 5

This session reinforced relaxation breathing as a tool for managing internal distress. The practical on-court exercise manipulated task and environmental constraints, and was designed to challenge player focus under varying levels of pressure. Relaxation breathing was constrained to help players regain their composure and manage their internal experience.

Session 6

This session aimed to bring awareness to negative thinking. The practical on-court exercise manipulated task constraints and was designed to elicit various experiences of thinking to challenge players under expectations. Self-talk was introduced to help players become aware of their thoughts and regain their focus.

Session 7

This session aimed to build on the topic of focus and negative thinking. The practical on-court exercise manipulated task constraints and was designed to build on various distractions and negative thinking in competition. Self-talk was reinforced to help players regain their focus by using their verbal cue.

Session 8

This session challenged the players holistically with regard to focus and negative thinking in a live scrimmage environment. The practical on-court exercise was designed to elicit various internal and external distractions and negative thinking. Players had the autonomy to self-select their mental skill of choice to handle the experience most effectively.

Assessments

Demographic Information

Personal and sport demographic information was collected, including years of experience playing basketball, number of hours spent practicing or playing basketball per week, and their experience with mental skills training (see Appendix A).

Mental Skill Proficiency

Participants completed a subset of the TOPS 2 (Hardy et al., 2010) at the beginning and end of the intervention to measure proficiency in the mental skills of interest: self-talk,

relaxation, and focus. The TOPS measures a variety of mental skills used by athletes in practice and in competition. The subscales selected correspond with the skills being coached in the intervention and included self-talk, relaxation, and attentional control for practice. For competition, self-talk, relaxation, and negative thinking were measured. Thomas et al.'s (1999) original validation of the survey found that negative thinking in competition was the metacognitive expression of a lack of attentional control in practice and, thus, determined negative thinking to be the corresponding relevant construct to attentional control for competition. Participants responded to four items for each of the three skills in practice and in competition, totaling 24 items. Responses ranged from "never" to "always" on a 5-point Likert scale (see Appendix B), and responses were summed and averaged for each subscale.

Mental Skill Use

To understand the transfer of skills into competition, participants identified the frequency of use for the skills of interest in practice and competition. This 6-item questionnaire is the standard tool used to assess mental skill use at the training academy where the intervention was conducted. The questionnaire assessed three different mental skills, including self-talk, breathing for relaxation, and focus cues for attentional control. Participants responded to two items for each of the three skills, identifying the frequency with which they intentionally use the skills in both practice and competition. Each skill ranged in frequency from "do not use" to "daily" on a 6-point Likert scale (see Appendix C).

Post-Session Ratings

To assess session perceptions, post-session ratings were collected regarding participant perceptions of each session's effectiveness in developing the skills and their likelihood of transferring those skills to games. Participants responded to two questions at the end of each

session, including “How useful was this session in helping you learn about [insert skill of interest based on the session; e.g., breathing]?” and “How likely are you to use this skill in a game to help you [insert skill of interest based on the session; e.g., relax]?” Responses ranged from 1 to 5 on a 5-point Likert scale (see Appendix D).

Post-Program Evaluation

To assess the participants overall experience of the intervention, participants completed a post-program evaluation asking the extent to which they agreed or disagreed to a variety of statements regarding their increase of knowledge, their experience, and their likelihood of using or transferring the mental skills to games. Participants were also asked open-ended questions about what they liked about the program and changes they would suggest for program improvement (see Appendix E).

Data Analysis

The study looked at the de-identified data from basketball players who completed the constraints-led intervention to assess the research objectives. Data were downloaded into IBM SPSS Statistics for Windows (Version 28) from Qualtrics or through manual entry, where cleaning, subscale calculations, and analyses occurred. Differences in participant responses to the TOPS 2 and Mental Skill Use questions from pre- to post-intervention were compared using a paired t-test to determine the extent to which the intervention improved athletes’ mental skill proficiency, as well as their frequency of use of mental skills in practice and games. Additionally, descriptive statistics were analyzed for the post-session questions and the post-program evaluations to provide an indication of athlete intervention perceptions and overall experience of the program. Open-ended program evaluation responses were grouped into common categories and frequencies were reported.

Results

This study evaluated the effectiveness of a constraints-led mental training program on facilitating the development and use of mental skills. The mental training program was moderately well attended with an average adherence rate of 88%, ranging from 73-100% adherence across all of the sessions. Results are presented below.

Mental Skill Proficiency

Sample means for mental skills proficiency at pre- and post-intervention are shown in Table 2. Survey results suggested significant changes in the mental skill proficiency of relaxation from pre-intervention to post-intervention in practice, $t(26) = -2.255$; $p = .017$, but not in games, $t(26) = -.383$, $p = .353$. Significant changes were also discovered in the mental skill proficiency of focus from pre-intervention to post-intervention in practice, $t(26) = -2.184$; $p = .019$, but not in games, $t(26) = .081$, $p = .468$. Changes in skill proficiency for self-talk did not reach significance in practice, $t(26) = .070$, $p = .473$, or games, $t(26) = .467$, $p = .322$.

Table 2. T-Test Results for Relaxation, Focus, and Self-Talk Skill Proficiency

Skill	Pre-Intervention		Post-Intervention		*p* value	Cohen's *d*
	M	*SD*	*M*	*SD*		
Relaxation in practice	2.80	0.89	3.18	0.90	.017*	.442
Relaxation in games	3.42	0.53	3.47	0.53	.353	.075
Focus in practice	3.08	0.34	3.30	0.38	.019*	.428
Focus in games	2.81	0.53	2.80	0.48	.468	-.016
Self-talk in practice	3.60	0.70	3.60	0.74	.473	-.014
Self-talk in games	3.59	0.77	3.50	0.78	.322	-.091

* $p < .05$.

Note. Possible scores and range of actual responses spans from 1 – 5.

Mental Skill Use

Mean scores for skill use at pre- and post-intervention are shown in Table 3. Survey results suggested no significant improvements in the frequency of mental skill use of self-talk from pre-intervention to post-intervention in practice, $t(26) = -.795$; $p = .217$, or in games, $t(26) = .537$, $p = .298$. There were also no significant improvements in relaxation breathing for practice, $t(26) = -1.224$, $p = .116$, or games, $t(26) = -.803$, $p = .215$. Changes in frequency of skill use for focus did not reach significance in practice, $t(26) = -.866$, $p = .197$ or games, $t(26) = -.647$, $p = .262$.

Table 3. Descriptive Statistics of Relaxation Breathing, Focus, and Self-Talk Skill Use

Skill	Pre-Intervention		Post-Intervention		*p* value	Cohen's *d*
	M	*SD*	*M*	*SD*		
Relaxation in practice	4.04	1.843	4.50	1.556	.116	.240
Relaxation in games	4.04	1.755	4.31	1.644	.215	.157
Focus in practice	5.15	1.255	5.35	1.018	.197	.170
Focus in games	4.92	1.521	5.04	1.341	.262	.127
Self-talk in practice	4.73	1.511	4.92	1.440	.271	.156
Self-talk in games	4.73	1.564	4.58	1.554	.298	-.105

Note. Possible scores and range of actual responses range on a scale from 1-6. Use scores are categorized as follows: 1 = Never, 2 = Once per month, 3 = 2-3 times per month, 4 = Once per week, 5 = 2-3 times per week, 6 = Daily.

Post-Session Ratings

Survey results indicated that the sessions designed from a constraints-led approach were perceived by the participants to both facilitate learning of the skill ($M = 4.08$) and intent to use the skill ($M = 4.25$). See Table 4 for participant ratings.

Table 4. Post-Session Ratings Results for Helpfulness in Learning and Likelihood to Use Skills

Session Number and Skill				Very or Extremely Helpful	
	N	*M*	*SD*	*N*	%
Helpfulness in Learning the Skill					
Session 2 – Focus Cues	26	4.30	.68	23	88.5%
Session 3 – Focus Cues	24	4.08	.78	20	83.3%
Session 4 – Breathing	22	3.95	1.25	14	63.6%
Session 5 – Breathing	19	4.11	.99	13	68.4%
Session 6 – Self-Talk	26	3.92	1.16	20	76.9%
Session 7 – Self-Talk	21	4.10	1.30	17	81.0%
Likelihood to Use the Skill					
Session 2 – Focus Cues	26	4.54	.68	23	88.5%
Session 3 – Focus Cues	24	4.33	.78	20	83.3%
Session 4 – Breathing	22	4.14	1.25	14	63.6%
Session 5 – Breathing	19	4.16	.99	13	68.4%
Session 6 – Self-Talk	26	4.12	1.16	20	76.9%
Session 7 – Self-Talk	21	4.19	1.30	17	81.0%

Note. Possible scores and range of actual responses range on a scale from 1-5.

Program Evaluation

All 26 participants completed the program evaluation. Data from the program evaluation indicated that participants perceived that they learned as a result of the constraints-led mental training program (M = 4.42, SD = 1.027), with 88.5% of respondents indicating they agree or strongly agree with having learned a lot from the mental training program. When identifying what specifically they learned, open-ended responses suggested mental characteristics were top of the list, accounting for 50% of the comments. Of those comments, the ability to reset mentally after a mistake was the most frequently identified attribute (69.2%), followed by confidence (15.4%), and a mix of others (15.4%). In addition to mental characteristics, participants cited skills as a primary learning outcome, accounting for 46.2% of comments. Of the skill-based comments, breathing (66.7%) was the most frequently identified skill, followed by self-talk

(33.3%). There was no specific reference to focus cues as a skill learned. Open-ended responses for learning data are shown in Table 5.

Table 5. Descriptive Statistics and Open-Ended Responses on the Learning Experience of Program Participants

Themed Categories	*N*	*%fid*	*Open-Ended Examples*
Characteristics (*N* = 13, 50%)			
Ability to reset	9	69.2%	"How to reset after missed shots and bad plays"
Confidence	2	15.4%	"Keep believing in yourself"
Other	2	15.4%	"Not to focus on what I don't want to do wrong"
Skills (*N* = 12, 46.2%)			
Breathing	8	66.7%	"The importance of breathing"
Self-Talk	4	33.3%	"Positive self-talk"
Other (*N* = 1, 3.8%)			
About the Brain	1	100%	"How your mind effects your outcome"

Data from the program evaluation also indicated an intention to use the mental skills because of the constraints-led mental training program (*M* = 4.65, *SD* = .797), with 88.5% of respondents indicating they agree or strongly agree with being more likely to use mental skills because of the mental training program. When identifying what specific skills they would be likely to use, open responses suggested self-talk (42.3%) was the most frequently identified skill, followed by breathing (30.8%) and focus cues (15.4%).

Respondents also indicated they generally enjoyed their experience (*M* = 4.69, *SD* = .736), with 92.3% of respondents agreeing or strongly agreeing that they enjoyed the mental training program. Open-ended responses suggest that the best parts of the mental training program were the on-court exercises (34.6%), the overall learning that occurred (15.4%), and being able to apply the skills in the basketball environment (11.5%). While the skills of breathing, self-talk, and focus cues accounted for 76.9% of comments relating to what worked

best in the program, 11.5% of the comments pertained to the value of being on the court, as evidenced by comments such as, “inputting the breathing into actual basketball,” and “physically trying it out on the court.” Open-ended data regarding the best parts of the program and perceptions of what worked best are shown in Table 6.

Table 6. Evaluation Responses Regarding Program’s Best Parts and What Worked Best

Themed Categories	*N*	*%*	*Open-Ended Examples*
			Best Parts
On-Court Exercises	9	34.6%	“How to reset after missed shots and bad plays”
Overall Learning	4	15.4%	“Keep believing in yourself”
Ability to Apply Skills	3	11.5%	“Not to focus on what I don’t want to do wrong”
Mental Outcomes	3	11.5%	“Teaching myself to keep going”
Self-Talk	2	7.7%	“Self-talk”
Other	5	19.2%	“The teacher”
			What Worked Best
Self-Talk	9	34.6%	“self-talk”
Breathing	6	23.1%	“breathing”
Focus Cues	5	19.2%	“my cues”
Being On-Court	3	11.5%	“Physically trying it out on the court”
Other	3	11.5%	“everything”

Overall, 85% of responses indicated participants wouldn’t change anything about the program, while one comment (4%) suggested variation in the on-court activities.

Discussion

The purpose of this study was to evaluate a constraints-led mental training program designed to facilitate the development and use of mental skills. Specifically, it was hypothesized that participating in an 8-session mental skills training program that applied the constraints-led approach would improve youth basketball players’ mental skill proficiency and increase their use of these skills in practice and games.

On average, participants reported using the mental skills of relaxation, self-talk, and focus 1-3 times per week in practice and games. Additionally, overall scores on the TOPS-2 measure of mental skills proficiency reflected moderately strong proficiency with means ranging from 2.80 to 3.60. For comparison, mean scores reported in the sample of athletes included in the original development of TOPS-2 (Hardy et al., 2010) ranged from 2.18(SD = 0.83) to 3.44(SD = 0.66). The favorable ratings observed in the present sample of youth basketball players could be due to nearly half of participants having previously experienced mental skills training. However, all skills have room for improvement, with most scores falling within the mid-range of the scale.

A primary goal of a constraints-led mental training program is to contribute to the development of mental skill proficiency in practice and games. Findings suggest that participants developed their proficiency to relax and focus in practice, supporting the hypothesis that participating in an 8-session mental skills training program that applied the constraints-led approach would improve youth female basketball players' mental skill proficiency in practice. However, players did not improve in self-talk proficiency. One possible explanation for why relaxation and focus were improved while self-talk was not could be due to the nature of the constraints-led model, as it pertains to the perception-action cycle. The model is predicated on the coupling of information and action to produce a skill that serves as a necessary solution for the demand (Renshaw & Chow, 2109). In this case, the skills trained to develop the solutions of relaxation and focus were behavioral actions, such as breathing, physical cues requiring the performer to engage in a gesture, or visual cues requiring the performer to move their eyes to a specific target. All of these skills require the performer to act with physical movement to express the skill. Conversely, self-talk often occurs as internal dialogue, characterizing it as more of a cognitive or internal experience than a physical action (Stephane et al., 2021). Furthermore,

internal dialogue has been characterized as intuitive to the point of being unnoticeable (Stephane et al., 2021). This distinction may have inhibited the perception-action cycle due to the performers' lack of awareness to attune to the information (Renshaw & Chow, 2019) and take outward action (Chow et al., 2015), resulting in a lack of skill expression. Future research might benefit from exploring overt self-talk that is outwardly verbalized to determine if such an action would result in greater skill proficiency.

Additionally, session construction may have contributed to the differences in outcomes between relaxation and focus that demonstrated skill proficiency development in comparison to self-talk, which demonstrated non-significant development. In the constraints-led approach, effective perception-action coupling emerges when practitioners strategically design-in the information necessary to create affordances for action (Renshaw & Chow, 2019). This occurred for both the relaxation sessions and the focus sessions, where usage of the skills itself was strategically constrained as part of the task manipulations. For example, in the activity in session three of the intervention, players were not allowed to re-enter the game until they outwardly engaged in their physical cue, constraining the task in such a way as to demand the use of the skill to progress in the activity. However, while the intervention intended to do the same for the skill of self-talk and was reviewed in advance by other CMPCs to achieve this aim, it is possible the same did not occur for self-talk sessions, where, instead, the environment represented the demands of the basketball environment, but specific constraints to manipulate self-talk skills were absent. For example, in session six of the intervention, players competed in a shooting exercise that elicited different forms of self-talk and then they were encouraged to use a verbal cue prior to shooting in the next round. There was no specific constraining of the skill to execute the activity. This distinction may have removed the necessity for the learner to engage in the

actions necessary to produce the desired task-related outcomes (Chow et al., 2015), resulting in limited impact on skill development for self-talk. Curiously, although there was no improvement in self-talk proficiency, open-ended responses indicated self-talk as the skill that participants felt worked best and would be most likely to use. This inconsistency could be due to a recency effect, as self-talk was the final skill addressed in the intervention overall. It could also be the result of a misalignment between players resonating with the skill in their experience and their lack of awareness when using the skill. Given the various possibilities affecting the potential effectiveness of self-talk as a trainable skill through the constraints-led approach, future research should not overlook self-talk within the constraints-led framework.

The constraints-led model aims to create environments that enable learners to self-organize and find solutions to achieve desired outcomes. The desired outcomes of relaxation and focus were achieved in practice settings, although no frequency of use changes were reported. These findings do not support the hypothesis that participating in an 8-session mental skills training program that applied the constraints-led approach improves youth female basketball players' mental skills use. However, this could be attributed to the Gibsonian view of perception-action, on which the constraints-led model is based. This view suggests that performance emerges under constraints that shape the perception-action coupling in the performance environment (Gibson, 1979) and not that the mind is a detective searching for cues to execute skills prior to taking action (a concept endorsed by Brunswick (1955) but not Gibson). This could be why players reported increased skill proficiency without necessarily reporting the use of specific skills to achieve this development (Davids et al., 2008).

To provide an analogous sport skill example, it is common in basketball for players to practice their shot on a shooting machine, where the rebound net rises a few feet above the rim of

the hoop. While this helps with rebounding the ball, it also serves as a height over which the shot needs to clear before going into the basket. This helps players put a higher arc on their shot, increasing the chances of a made basket. As the player shoots and clears the height, enhancing their arc, they can tell that the outcome is being achieved; however, the environment is not directing which skills they should use to succeed at the task. As such, players can use their legs to jump higher, their release point to shoot the ball from different heights, or their follow through to assist with the shot. However, most players are not focused on which specific technique they use to clear the net, they just know they are achieving the outcome of a higher arc on the ball. This experience reiterates that performers self-organize under constraints that shape the perception-action coupling toward desired outcomes without mental representation of which skill they will use to do so, further aligning with the results that an increase in skill proficiency was reported while skill usage was not.

Given that there were no significant improvements in mental skill proficiency or use in games, the hypothesis that participating in an 8-session mental skills training program that applied the constraints-led approach would improve youth female basketball players' mental skills and skill use in games was not supported. It is possible that no differences were observed due to only having two sessions to learn about and practice each skill. While the 8-session program was intentionally selected in order to accommodate the pre-season timing of the basketball season, Renshaw and Chow (2019) identify the need for performers to be exposed continually to affordances in the environment in order for performers to become attuned to them. This might suggest that two sessions for each skill was insufficient to elicit skill expression in games. Furthermore, only presenting two sessions on each skill inherently limits the variation of information in practice that would mirror the variation of context present in games (Newell,

1986). Additionally, the exercises that comprised the intervention were crafted much like basketball practice, with the intention of designing training that is more representative of sport demands than the traditional psychoeducational workshop (Hamilton et al., 2020). With results indicating the development of skill proficiency in practice, it appears that approach may have been successful. However, future research could look to design more exercises using game-like scrimmages to more closely represent the demands of the game. Overall, findings suggest that a constraints-led mental training program can serve as a useful approach to enhancing mental skills in practice, a necessary step in the pursuit of those skills in games (Hamilton et al., 2020).

Participants enjoyed the constraints-led mental training program, learned about mental skills and outcomes, and expressed intention to use the skills as a result, which was also corroborated by post-session perception responses. Participants described their favor toward the training program being on the court for allowing them the opportunity to practice the mental skills in the basketball environment, a key tenet of the representative learning design approach (Pinder et al., 2011). Overall, the findings show promise and suggest that a constraints-led mental training program may be an enjoyable and potentially effective program for facilitating the development of mental skills.

The evaluation of one of the first constraints-led mental training programs has a number of implications. This research reveals that the constraints-led approach to skill development can be useful not only for physical skills (Reid et al., 2007; Renshaw et al., 2010; Araújo et al., 2013), but for mental skills as well. Mental performance coaches can leverage this approach as an option when designing mental training programs for their own athletes. Additionally, sport coaches can consider this approach when attempting to incorporate mental training into their own practices, given the utility of the training environment as a fundamental part of the program

(Pinder et al., 2011). Furthermore, this approach to mental training might assist MPCs in creating not only knowledgeable trainees of mental skills through psychoeducational workshops, but also in developing skilled performers through representative learning design and constraints-led coaching (Ward et al., 2008).

Limitations, Future Directions, and Conclusions

Future research could benefit by addressing limitations of the present study. The sample of this study is a limitation, both in size and variation. The current sample size is small and the variability in participant demographics present a less-clear picture of where impact is greatest. A larger and more targeted sample size would contribute to more statistical power, and help to discern differences between participant demographics, including age, sport experience, and skill expertise. Future research might also find interest in evaluating this type of program across a variety of sport contexts, as well as using a control group to shed light on the effectiveness of the program in comparison to other mental training approaches. Finally, due to the limits of self-report data, future research could also consider more behaviorally-driven assessment tools in order to determine objective changes in skill proficiency and use.

As Hamilton et al. (2020) suggested, a constraints-led mental training program can assist in facilitating the development of mental skills in youth basketball players. As a training method that situates mental skills in the performance environment, a constraints-led mental training program shows promise in providing the necessary context for athletes to learn, retain, and transfer mental skills to facilitate optimal performance, and provides a model from which MPCs can effectively develop mental skills in athletes that can positively impact their athletic performance.

CHAPTER II: DISSEMINATION

The initial dissemination of this research will be targeted toward the mental performance professionals belonging to the Association of Applied Sport Psychology (AASP) professional organization. AASP is an international organization comprised of nearly 3,000 researchers, educators, applied practitioners, clinicians, and students in the field of sport psychology who seek to advance the application of mental performance and mental health. The purpose for selecting this audience is twofold:

1. As a current member of the Science to Practice Committee within AASP and a practitioner committed to evidence-based practice, it is important to continually link theory and data to applied work in the mental performance space and demonstrate a theoretically driven approach to intervention design, not just intervention selection.
2. Provide mental performance coaches with a novel approach to designing sessions aimed at increasing creativity of work while enhancing transferability of mental training into the performance space, a challenge regularly faced by practitioners in applied sport psychology.

Each year, AASP holds a conference that gathers these professionals in one place to share insights, research, and applied best practices. It would be to this conference that a presentation of the findings would be submitted. Abstract submission deadline is February 2023 and conference presentation would hopefully take place in October 2023 in Orlando, FL. Should the submission be accepted for presentation, I would discuss the tenets of representative learning design and constraints-led approach to skill development as it applies to mental skills. I would also include a description of the study participants, intervention procedures, results, and conclusion. To provide presentation attendees with a hands-on workshop experience, I would also tailor one of the

intervention sessions to apply to a conference setting so attendees can experience a constraints-led mental training session. Presentation slides are included in Appendix H.

Presentation Script

Title Slide (Slide One)

Hi, I'm Lindsey Hamilton, Head of Mental Performance at IMG Academy and recent doctoral graduate from UNCG Department of Kinesiology. I'm excited to share with you about my dissertation research called Train your brain the way you play: A constraints-led approach to developing mental skills in sport, and the implications for that in application with your athletes.

Basketball Image and Background Literature (Slides Two and Three)

Imagine. It's the end of the basketball game with the ball in your hand and your foot on the free throw line. You have two shots left. If you make it, you send your team to the championship game, and if you miss, season is over. The stadium is full of people yelling and booing and cheering and all eyes on you and all of a sudden, this shot matters. Imagine the pressure! Will you have the mental skills you need to perform at your best in this moment? The ability to focus the mind during moments of intense pressure like this is paramount to athletic success (Swann et al., 2016). As such, mental training has gained significant interest in the athletic arena to develop mental skills that athletes can learn and use to facilitate successful performance (Gould et al., 2002; Hanton & Neil, 2019). Pinder and colleagues (2011) have posited a framework to facilitate this skill development and its transfer into competition, called representative learning design (RLD). Specifically RLD refers the degree to with the demands of the practice environment mirror the demands of competition. When it does, skills can be transferred into the performance environment much more consistently (Davids et al., 2013).

Mental performance consultants (MPCs) like us are tasked with improving the transferability of mental training into the competitive environment so that athletes can apply and use mental skills to enhance optimal performance. However, mental training sessions are often conducted in a classroom or workshop setting – both of which are very unlike the setting to which the mental skills need to be transferred (Hamilton et al., 2020).

One possible model that can guide MPCs in the development of representative learning environments is Newell's Model of Interacting Constraints (Newell, 1986). With Newell's Model, skill development is a function of the interaction between the environment and the performer. That relationship is determined based on a set of constraints, or features, that ultimately impact the skill necessary to be successful. The three categories of constraints include task, performer, and environmental. Coaches can manipulate these constraints to create new opportunities for an athlete to perform or express new skills, and this has been done throughout the literature in a variety of physical and sport skills including tennis, cricket, soccer, rugby, and PE (Araújo et al., 2013; Reid et al., 2007; Renshaw et al., 2010). However, it has not been examined in application for mental skills.

Hamilton and colleagues (2020) suggested Newell's model as a possible solution for making mental training more representative of competition and called for an applied constraints-led intervention to determine its usefulness in enhancing the development and transfer of mental skills.

Purpose and Methods, Participants, and Program (Slides Four through Six)

As such, the purpose of my dissertation was to evaluate a constraints-led mental training program designed to facilitate the development and use of mental skills. The hypothesis was that that participating in an 8-session mental skills training program that applied the constraints-led

approach would improve youth basketball players' mental skills and increase their use of these skills in practice and games.

In order to meet these aims, I evaluated a constraints-led mental training program that took place at a youth high school. Twenty-six competitive youth female basketball players (aged 15-18 years) participated in the program, 69% of whom had been playing organized basketball for more than six years, 50% spent 14 or more hours per week playing basketball, and 54% of the participants were in their first year of mental training. Participants completed a subset of the TOPS 2 (Hardy et al., 2010) to measure baseline proficiency in the mental skills of interest, a mental skill utilization scale to assess how often participants use these skills in practice and competition, two post-session questions, and a post-program evaluation.

The intervention of interest is a constraints-led approach, taking into consideration the psychological demands of basketball, and particularly emphasizing development of the mental skills self-talk, relaxation breathing, and focus cues. The step-by-step process for designing the session was informed by Hamilton et al. (2020). The program consisted of eight sessions with an emphasis on the task, environmental, or performer constraints that elicit psychological experiences that mirror competitive basketball situations. The eight sessions occurred over the course of 15 weeks, were conducted on a basketball court, in a practice environment, and each lasted 30 minutes.

Pressure Scoring and Breathing Practice (Slide Seven)

To give you an idea of what one of the constraints-led sessions is like, let's give it a try. I need 12 volunteers. Who wants to play? [Spend time collecting volunteers and splitting them into three groups, each with a washer board and washers for each player.]

Here's how we're going to play. One person in the group is standing near the washer board without a washer, ready to rebound the toss while the remainder of the group is standing in a line near the spot for the toss (set the toss range roughly 10 feet from the board). The first person in line takes their toss, attempting to score. If they score, it counts as 1 point for the group. If they miss, no points are awarded. The rebounder then collects the washer and goes to the end of the line to wait their turn, while the next person in the line takes their toss. The person who tosses becomes the rebounder, and the rotation repeats. Keep track of your team's total points.

Now there's one more rule before we get started. As soon as the exercise begins, everyone will hold their breath for the duration of the round *(hello, performer and task constraint!).* As soon as the round begins, all people in all teams hold their breath and begin to play. As soon as any individual needs to breathe, they simply remove themselves from the play and can no longer participate in that round. They can't become the rebounder, they are out. When the last person in their team needs to breathe, they are done with the round. NOTE: no extra points for passing out. Safety is crucial. Any questions?

Ready? Take a deep breath and GO! (Be sure to time the round for how long it takes.)

[Once the round is over, I will facilitate the mid-debrief of the exercise with questions such as what was it like? How did it feel? Why was it hard? How many points did you score? (Typical answers: "It was hard to focus because I was focusing of how I felt;" "I felt rushed;" etc.). This is a good time to reinforce that when you don't use your breath to your advantage, it's easy to put your mind on the wrong things, rush, make mistakes, or feel sped up. *I will then take this time to introduce diaphragmatic breathing, and teach the basics of the skill.]*

Now, play the round again, but each time before you shoot *(information),* you have to take a diaphragmatic breath *(action).* No more holding your breath! If you don't take the breath, the shot doesn't count. [Play the round for the same amount of time it took the first round, to keep it fair.]

[Once the round is over, again facilitate the debrief by asking asking questions to solicit their experience: "How was that different?" "What did it feel like?" (Typical answers: easier, more relaxed, more focused.) This is a good time to reiterate how the breath can help manage focus and facilitate more effective thinking. Also, ask how many points they scored. Almost always, they scored more points. This reinforces the breath in enhancing performance.]

Basketball Image and Results (Slides Eight through 10)

Thank you so much for joining me, please feel free to take your seats. Now that was one example of how a constraints-led mental coaching session was constructed, but in a basketball environment with free throw shots. Now, what did we find?

Results looked at the use of skills, the development of skills, and what the participants thought about the program in general. Differences in participant responses to the TOPS 2 and Mental Skill Use questions from pre- to post-intervention were compared using a paired t-test to determine the extent to which the intervention improved athletes' mental skills, as well as their use of mental skills in practice and games. Additionally, means and standard deviations were analyzed for the post-session questions and the post-program evaluations to provide an indication of athlete perceptions of the intervention and overall experience of the program.

Findings suggest development in practice for relaxation ($p = .017$) and focus ($p = .019$), but not in games. There were no significant impact on self-talk skills in practice or games, and no significant differences in reported skill usage across either setting. One possible explanation

for this could be due to the nature of the constraints-led model, as it pertains to the perception-action cycle. The model is predicated on the coupling of information and action to produce a skill (Renshaw & Chow, 2109). Breathing and physical cues require the performer to act with physical movement to express the skill, whereas self-talk often occurs as internal dialogue (Stephane et al., 2021). This distinction may have inhibited the perception-action cycle due to the inability for performers to take outward action (Chow et al., 2015), resulting in a lack of skill expression.

While skills were developed in practice, there were no significant improvements in mental skill development or use in games. It is possible that no differences were observed due to a limited number of sessions for each skill or because the exercises were designed more like practice than like games. Evolutions of this intervention could design more exercises using game-like scrimmages to more closely represent the demands of the game.

Overall, participants enjoyed the constraints-led mental training program, learned about the mental skills, and expressed intention to use the skills as a result. Post-session perception results demonstrated that each individual session contributed to the learning and anticipated use of the relevant mental skills as well. Participants even described their favor toward the training program being on the court for allowing them the opportunity to practice the mental skills in the basketball environment, a key tenet of the representative learning design approach (Pinder et al., 2011).

Your Turn: Application to Practice, and Thank You (Slides 11-12)

Overall, the findings suggest that a constraints-led mental training program may be a potentially effective program for facilitating the development of mental skills. So how can MPCs use this model to build mental training sessions?

The first step is to clarify the aspects of competition that need to be represented in training (e.g., managing anxiety in a certain performance situations). The second step considers what information and actions need to be coupled to successfully perform a required skill under those demands (e.g., diaphragmatic breathing while being watched by spectators during that performance scenario). The third step requires coaches to strategize which performer, task, or environmental constraints should be manipulated to create the identified coupling and train the mental skill in a representative way. For example, in a hitting exercise, we might want to help the batter manage their anxiety at the plate. To do so, we want the athlete to develop the skill of breathing in that situation to decrease their somatic anxiety during the task. As MPCs, we can design practice under manipulated constraints, such as introducing spectators (environmental constraint) in a one-pitch challenge (task constraint), during which they will have to use the breath before they can bat.

Now, let's get into groups. Each group will be assigned a sport and a mental skill. Using these three steps, create a constraints-led mental session to develop the skill assigned in that sport. [Provide time for brainstorming with groups and sharing back their designed sessions.]

Thank you everyone for sharing. I hope that we're all walking away today seeing the value of constraints-led mental training and even a few exercises we can use to implement that approach. As a training method that situates mental skills in the performance environment, a constraints-led mental training program can provide the necessary context for athletes to learn, retain, and transfer mental skills into competition to facilitate optimal performance, and provides a model from which MPCs can effectively develop mental skills in athletes that can positively impact their athletic performance. Thank you for joining me today, and I would love to open the floor for questions.

CHAPTER III: ACTION PLAN

Following the initial short-term goal of delivering a presentation at AASP, I would then attempt to disseminate the information more broadly, in both audience and depth of information. For starters, I am in the process of refining the "Mental Playbook for Basketball." The Playbook describes the intervention that was implemented which the current study evaluated and provides instructions, necessary materials, and visual diagrams of how to conduct the sessions. This Playbook is specifically designed for MPCS, as the descriptions are currently written under the assumption that the readers would know how to teach the various skills addressed. The Play book describes several on-court exercises that are intended to develop mental skills. Each exercise includes the following components:

1. The mental skills to be developed
2. The instructions for the exercise
3. The constraints under consideration, and
4. The information and actions that are intentionally coupled to elicit skill expression.

In comparison to the presentation, the book would allow for greater depth on representative learning design, the constraints-based model, the various constraints, and the benefits of the approach for mental skill development. It would also allow for more time and space to elaborate on a variety of exercises aimed at different skills.

Another immediate action step for dissemination of this information is to create a Mental Playbook for other sports such as soccer or baseball. Many of the exercises can be transitioned into other sport domains and my depth of knowledge in the sport combined with expertise from colleagues would allow for additional tailoring and adding new sessions in instances where the original basketball exercises do not transfer.

A more long-term action step for dissemination is to further refine the Playbook but with sport coaches as the intended audience. This book would be for those who want to incorporate more mental training into their own practices, should a mental performance consultant not be accessible. This project would be a longer-term process due to the need to add more instruction on the mental training perspective of the content, including why certain skills are selected, how they benefit the athletes, and more specific instruction on how to appropriately teach the skills.

From a scholarly perspective, future research could be conducted as a long-term goal, specifically investigating the limitations of the study. This could include replicating the study with a more powerful sample in both numbers and targeted demographics. Given the opportunity, I would conduct the study again with a larger sample of male basketball players of similar demographics to each other. Iterations of the study could inquire about skill level of the players to determine its influence (if any) on outcomes. A much longer-term goal would be to experiment with different intervention dosages per skill, or innovate application to new sports. This would be a future endeavor further down the road due to the need to design additional sessions and on-court exercise to facilitate skill development and use. Most optimally, a study design that compared the constraints-led program to a control group of some sort would allow for observation of the effectiveness in comparison to other forms of intervention implementation. These research directions would help practitioners better understand the generalizability of the effectiveness of the intervention as a whole, and deepen our understanding of constraints-led mental training. In order to take this step, it would be valuable to explore partnerships with other universities who are interested in the topic and can provide IRB support to conduct the research. This could aid the university programs by providing ecologically valid research opportunities in

the applied mental performance space, while leveraging the player population in a real environment to evaluate the mental training being conducted.

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APPENDIX A: DEMOGRAPHIC QUESTIONNAIRE

Age in years:

Gender:	Woman	Man	Transgender Female	Transgender Male	Non-binary	Prefer not to say

Which categories describe you? Select all that apply to you:

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic or Latino
- Middle Eastern or North African
- Native Hawaiian or Other Pacific Islander
- White/Caucasian
- Other race, ethnicity, or origin, please specify: _____
- I prefer not to answer.

Years of experience playing organized basketball

- This is my first season of organized basketball
- 1-2 seasons of organized basketball
- 3-4 seasons of organized basketball
- 5-6 seasons of organized basketball
- More than 6 seasons of organized basketball

Average number of hours spent practicing or playing basketball per week (please consider practice and game times)

- 0 – 2 hours
- 2.01 – 5 hours
- 5.01 – 8 hours
- 8.01 – 11 hours
- 11.01 – 14 hours
- More than 14 hours

For how long have you engaged in mental training?

- This is my first season of mental training
- 1-2 seasons of mental training
- 3-4 seasons of mental training
- 5-6 seasons of mental training
- More than 6 seasons of mental training

APPENDIX B: TEST OF PERFORMANCE STRATEGIES 2

Directions: Each of the following items describes a specific situation that you may encounter in your training and competition. Please circle how frequently these situations apply to you on the following 1 – 5 scale:

	Never	**Rarely**	**Sometimes**	**Often**	**Always**
I say things to myself to help me practice performances.	1	2	3	4	5
My attention wanders while I am training.	1	2	3	4	5
I practice using relaxation techniques at workouts.	1	2	3	4	5
I practice a way to relax.	1	2	3	4	5
When the pressure is on at competitions, I know how to relax.	1	2	3	4	5
My self-talk during competition is negative.	1	2	3	4	5
During competition I have thoughts of failure.	1	2	3	4	5
I use practice time to work on my relaxation techniques.	1	2	3	4	5
I manage my self-talk effectively during practice.	1	2	3	4	5
I am able to relax if I get too nervous at a competition.	1	2	3	4	5
I am able to control distracting thoughts while I am training.	1	2	3	4	5
I have specific cue words or phrases that I say to myself to help my performance during competition.	1	2	3	4	5
When I need to, I can relax myself at competition to get ready to perform.	1	2	3	4	5
I relax myself at practice to get ready.	1	2	3	4	5
I keep my thoughts positive during competition.	1	2	3	4	5
I say things to myself to help my competitive performances.	1	2	3	4	5

I manage my self-talk effectively during competition.	1	2	3	4	5
I find it difficult to relax when I feel too tense at competition.	1	2	3	4	5
During practice, I focus my attention effectively.	1	2	3	4	5
I motivate myself to train through positive self-talk.	1	2	3	4	5
I have trouble maintaining my concentration during long practices.	1	2	3	4	5
I talk positively to myself to get the most out of practice.	1	2	3	4	5
I imagine screwing up during competition.	1	2	3	4	5
I talk positively to myself to get the most out of competitions.	1	2	3	4	5

APPENDIX C: MENTAL SKILL USE

Please rate how OFTEN you use the following mental skills in PRACTICE:

	Do not use	Once a month or less	2-3 times a month	Once a week	2-3 times a week	Daily
Self-talk						
Focus						
Relaxation Breathing						

Please rate how OFTEN you use the following mental skills in GAMES:

	Do not use	Once a month or less	2-3 times a month	Once a week	2-3 times a week	Daily
Self-talk						
Focus						
Relaxation Breathing						

APPENDIX D: POST-SESSION QUESTIONS

How useful was this session in helping you learn about [insert skill of interest based on the session, e.g., breathing]?

	1 – Not useful at all	2 – Somewhat useful	3 – Useful	4 – Very useful	5 – Extremely Useful
Session-specific skill					

How likely are you to use [insert session skill of interest, e.g., breathing] in a game to help you [insert skill of interest based on the session, e.g., relax]?"

	1 – Not likely at all	2 – Somewhat likely	3 – Likely	4 – Very likely	5 – Extremely likely
Session-specific skill					

APPENDIX E: POST-PROGRAM EVALUATION

1. Overall, I learned a lot from the mental training program.

Strongly Disagree				Strongly Agree
1	2	3	4	5

2. Overall, I enjoyed the program.

Strongly Disagree				Strongly Agree
1	2	3	4	5

3. Because of the mental training program, I am more likely to use mental skills

Strongly Disagree				Strongly Agree
1	2	3	4	5

4. What's the most important thing you learned from the mental training program?
5. What was the best part of the mental training program?
6. When considering the skills of the program, which of the skills (breathing focus cues, or self-talk) will you use most often? Please describe when and how you will use them.

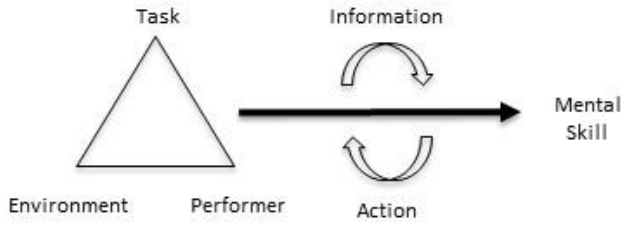
7. What specific aspects of the mental training program worked best?
8. What parts of the mental training program would you change or omit?
9. Other comments on your overall experience in the mental training program:

APPENDIX F: INTERVENTION DETAILS

The intervention was designed in accordance with Hamilton et al.'s (2020) conceptual suggestions. By identifying the skill necessary for each session, the information and action that needs coupling to produce the desired skills, and the constraint that will be manipulated to create the coupling, each session follows the necessary steps to create a representative environment for the mental skills of interest to be expressed.

SESSION	CONSTRAINT	COUPLING (INFORMATION + ACTION)	SKILL	EXERCISE
1	Task	Emotional distractions + Mental strategies	Intro	Whatever It Takes
2	Task	Pressure distractions + Physical cues	Focus cues	2-Ball
3	Task	Pressure ball handling + Physical cues	Focus cues	Dribble Tag
4	Task and Performer	Pressure scoring + Breathing	Breathing	Knockdown
5	Task and Environment	Pressure distractions + Breathing	Breathing	In the Bank
6	Task	Expectation distractions + Verbal cue	Self-talk	Rack 'Em Up
7	Task	Negative thinking + Verbal cue	Self-talk	10 Up
8	Task	Emotional distractions + Mental strategies	Application	Whatever It Takes

SESSION ONE

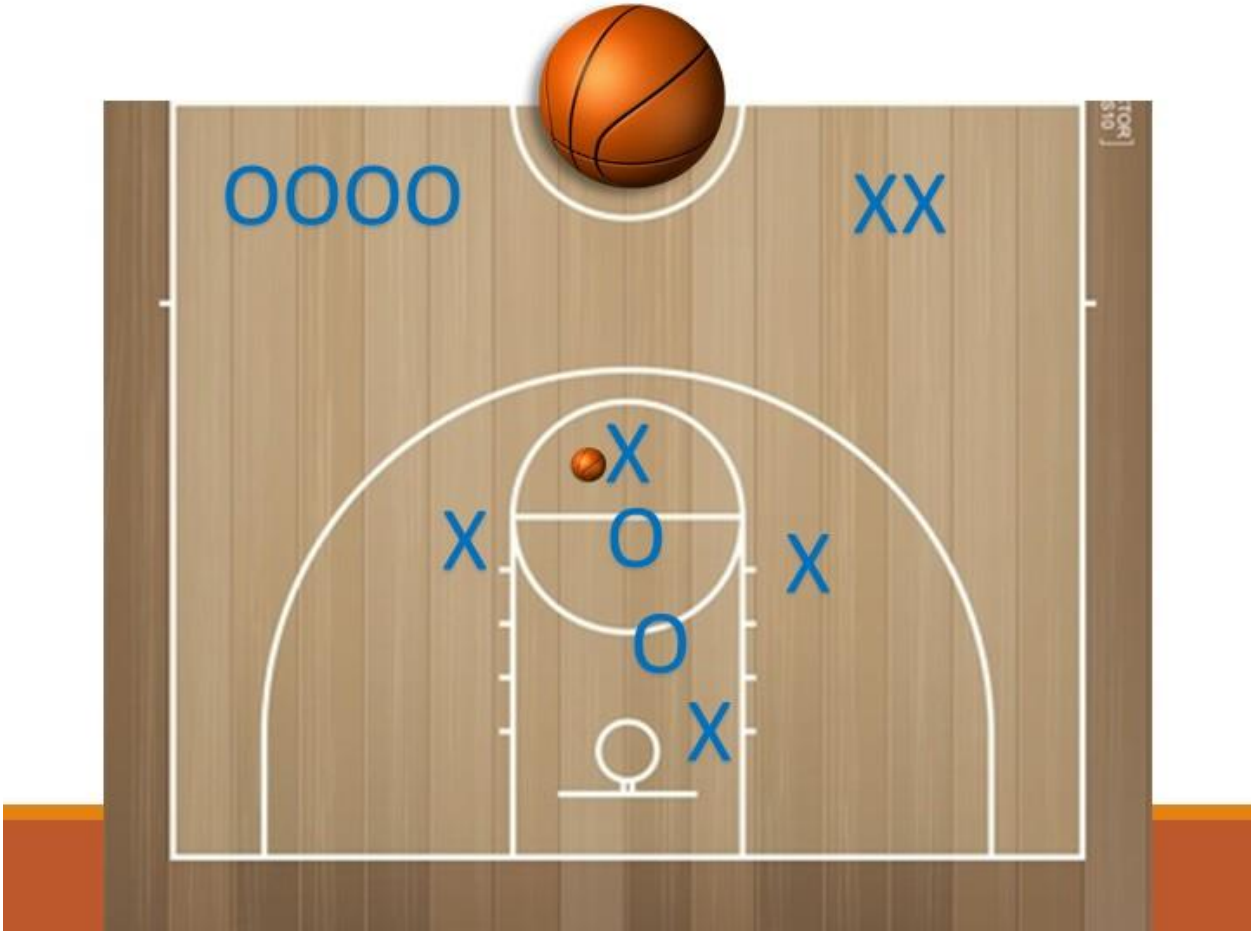


EXERCISE: Whatever It Takes

SKILL: Focus

COUPLING: Emotional distractions + mental strategy

CONSTRAINT: Task



SESSION ONE: WHATEVER IT TAKES

PURPOSE:
To put the players in an environment of setbacks where focus and negative thinking will be easily elicited, and see how they respond.

OBJECTIVE:
First team to score 7 points wins. Points are scored for a made shot (counting by ones) or a defensive rebound.

MATERIALS:
Half court, basketball, 2 dice

SET UP:
Split the group into two teams. Have one die for each team.

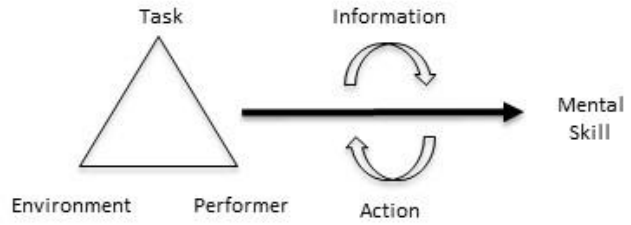
HOW TO PLAY:
Task constraint: To start the game, roll both dice. The number that shows up on the die is the number of players that the team can send out for that round (up to 5). So, if one die rolls a 2 and the other die rolls a 4, one team will get 2 players while the other team will get 4 players and they have to still play by the same rules to score.

Throughout the exercise, interrupt the game as desired. For example, call unfair fouls and turnovers. Whatever it takes. First team to 7 points wins.

DEBRIEF:
Highlight their response to the adversity. Ask what skills they used *(action)* to manage the frustration or difficulty *(information)* and bounce back. Demonstrate how their thoughts and emotions played a role in their performance and how they became distracted by unhelpful information.

VARIATION:
if a team roles an even number, they automatically get half the number of people as what they rolled. For example, if the team rolls a 4, instead of getting to send 4 people into the game, they only get to send 2 people into the game and they still need to complete the task. let individual players on the team roll the dice because they feel responsible for the outcome. It adds a little bit of pressure, a little bit of expectation, and a little bit of that letting your team down feeling into play. Gives good insight into player's approach or avoidance tendencies.

SESSION TWO

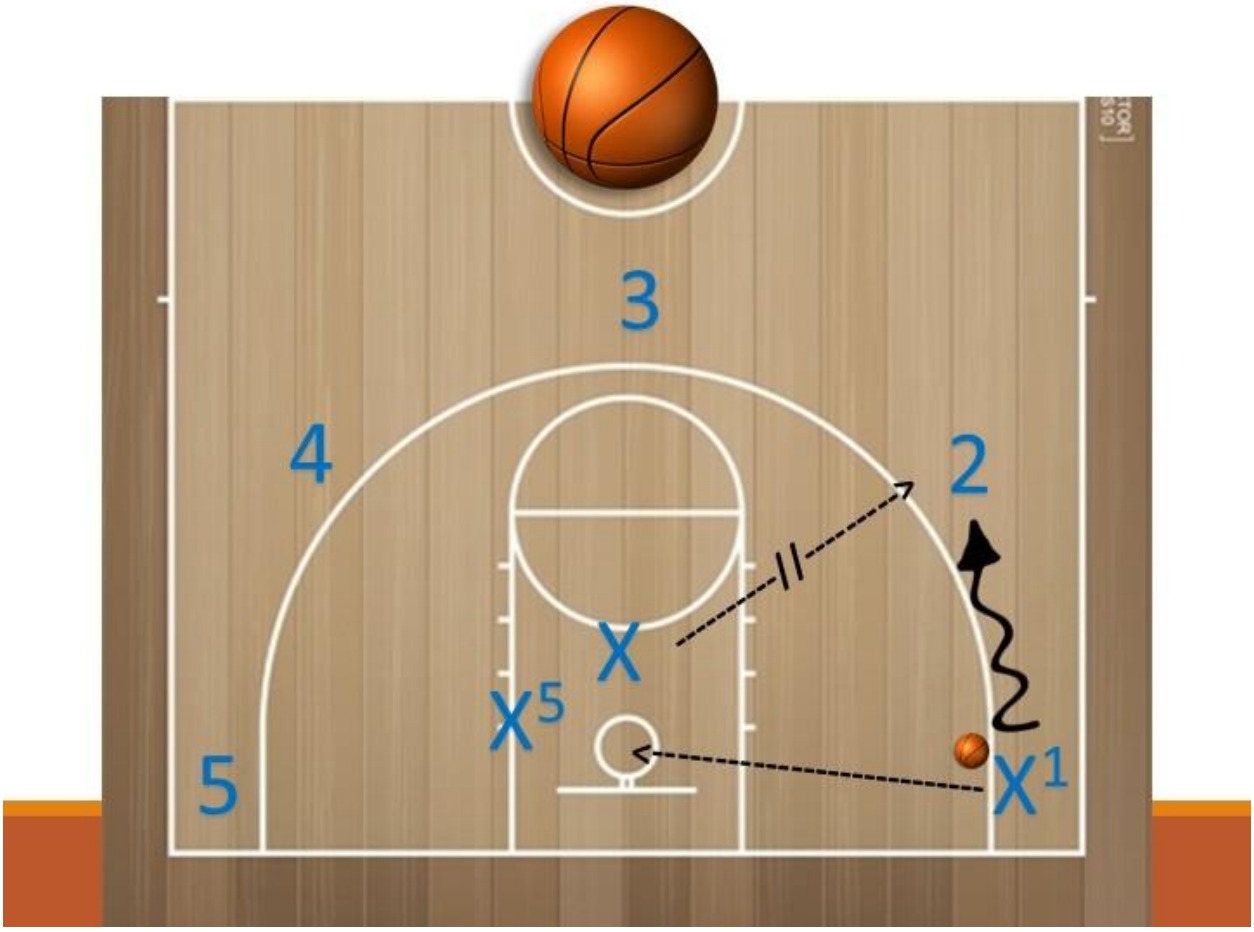


EXERCISE: 2-Ball

SKILL: Focus cues

COUPLING: Pressure distraction + physical cues

CONSTRAINT: Task



SESSION TWO: 2-BALL

PURPOSE:
To introduce pressure and competition into the environment to reinforce the use of physical and visual cues to manage focus and facilitate more effective thinking.

OBJECTIVE:
Be the first set of partners to complete 10 three point shots and 2 lay-ups.

MATERIALS:
Two balls, one basket, and half court space

SET UP:
Split the group into partners. Two sets of partners and two balls to a baskets. One player from each pair starts with a ball under the basket, while the shooting partner starts in the corner at the 3-point line.

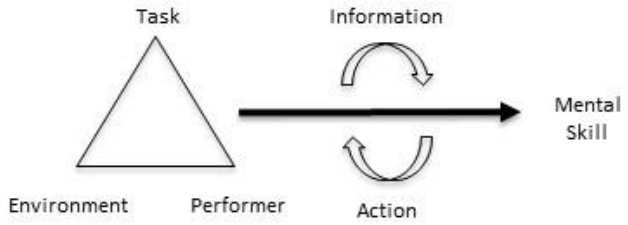
HOW TO PLAY:
Round 1: As soon as the game begins, the partner with the ball passes the ball to their partner at the 3-point line in the corner for shot 1. If the shooter misses, the rebounder passes the ball out again for another shot. The shooter continues to shoot from that spot until the shot is made. Once the shot is made, the shooter advances along the 3-point line to the wing for shot 2. This pattern continues through all 5 shot spots. After the shot is made from the 5th spot, the shooter comes in to shoot a lay-up (shot 6), while the rebounder moves out to the corner and becomes the new shooter. The partner who just made their lay-up now becomes the rebounder for the new shooting partner. The shooting partner completes the same task. Meanwhile, the other pair of partners is completing the same task. The set of partners to both successfully complete the task first, wins.

Mid-point debrief: Discuss the various points of pressure, distraction, and their thought patterns. Take this time to introduce and teach physical cues as a tool to reset their focus.

Round 2 *(task constraint):* Play the same way as above, but the shooters must use their physical cue *(action)* after each missed shot *(information).*

DEBRIEF:
Take this time to discuss their use of the cues, what worked, and what could be better. Understand how using their cues impacted their focus and thinking.

SESSION THREE

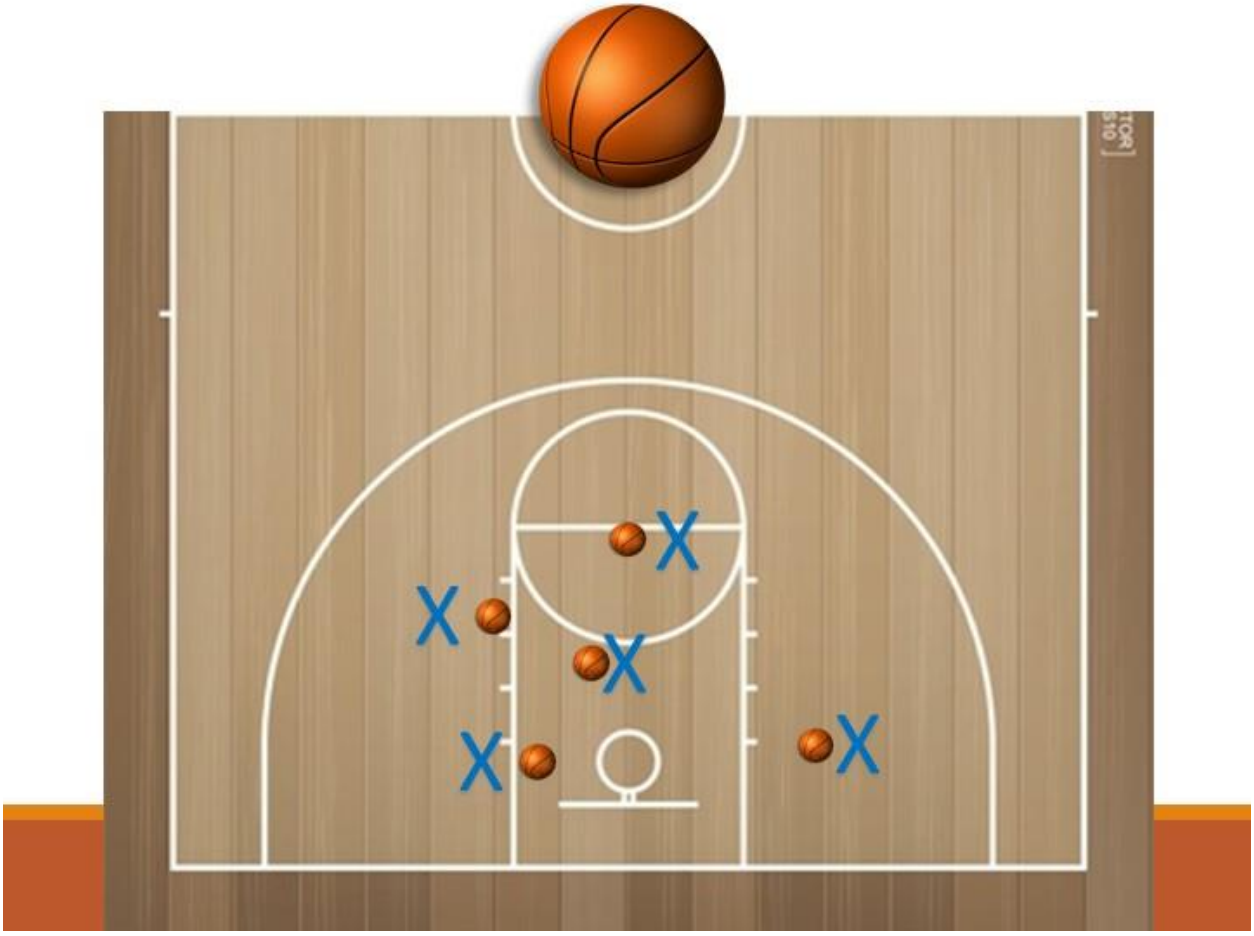


EXERCISE: Dribble Tag

SKILL: Focus cues

COUPLING: Pressure ball handling + physical cues

CONSTRAINT: Task



SESSION THREE: DRIBBLE TAG

PURPOSE:
To challenge athletes' ball handling skills in a way that will require mentally resetting to focus on the present moment using their physical cue.

OBJECTIVE:
To be the last remaining ball handler in the exercise.

MATERIALS:
Basketballs (one per person) and half court space

SET UP:
All players will have a ball in the half court space.

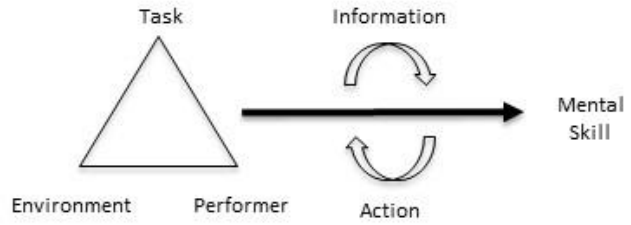
HOW TO PLAY:
In the half court space within the 3-point arc, each player will be dribbling a ball. Each player is attempting to 1) protect their ball from other people, and 2) knock other people's ball away. If someone's ball gets knocked out of the playing space, they are eliminated from the game. The dribbling space is made smaller and smaller as the number of players decreases, and the last person dribbling the ball in the playing space wins.

Round 2: The same rules as above apply for round two with the exception that when a player's ball gets knocked out, they can use their physical cue one time to immediately re-enter for the next play and another chance to compete and win. If their ball gets knocked out again, they are eliminated.

Task constraint: Players must use their physical cue once they are out before they can re-enter for the next play

DEBRIEF:
How does using your focus cues *(action)* help you to manage your thinking and focus to reset from mistake, frustration, or fatigue *(information)* in order to re-enter the game for the next play? How does not using your cue to refocus "take you out of the game" mentally?

SESSION FOUR

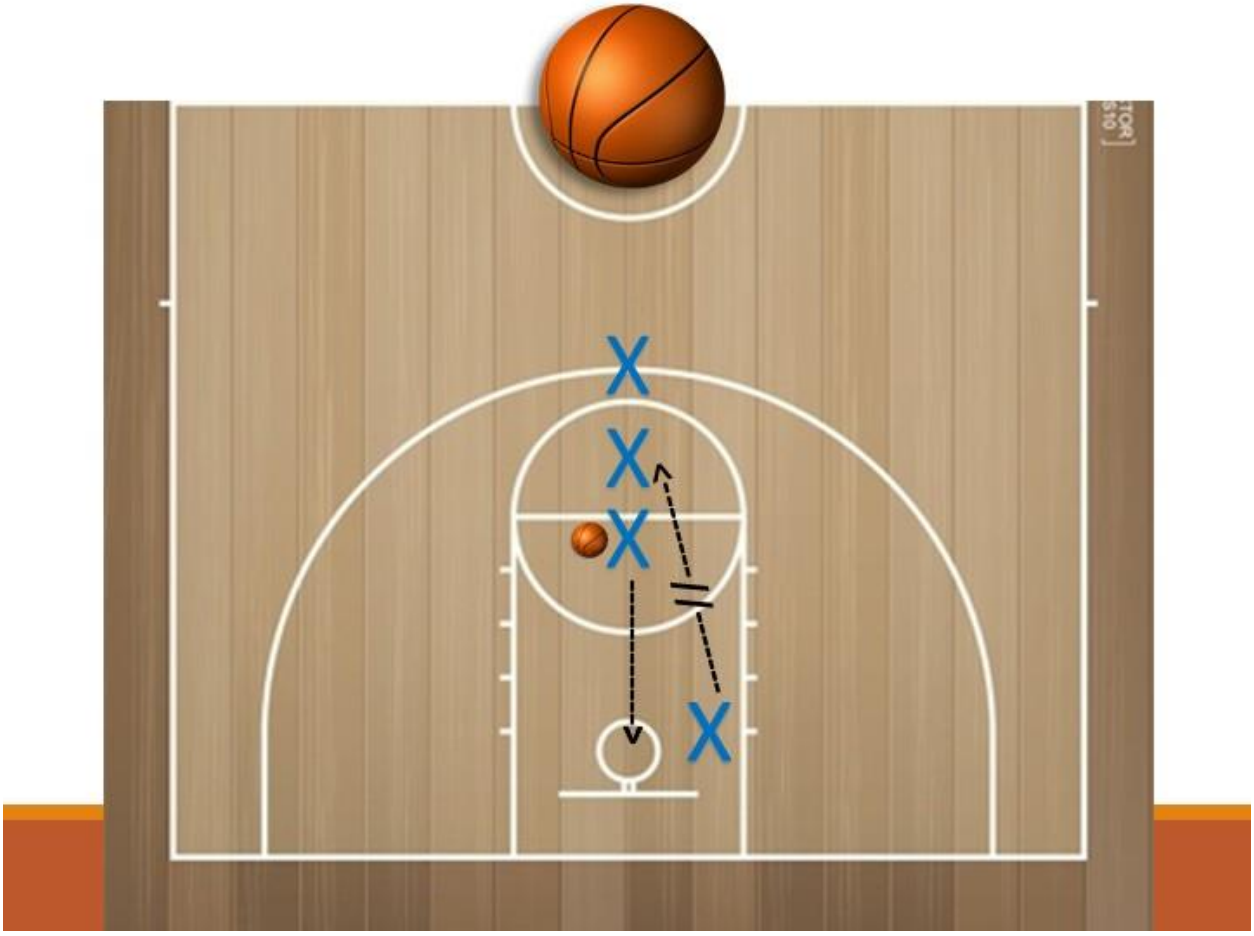


EXERCISE: Knockdown

SKILL: Breathing

COUPLING: Pressure scoring + breathing

CONSTRAINT: Task and Performer



SESSION FOUR: KNOCKDOWN

PURPOSE:
To introduce the power of breathing effectively for performance, specifically to manage focus and facilitate more effective thinking.

OBJECTIVE:
To score as many baskets as possible in the allotted time for each round.

MATERIALS:
3-4 basketballs and 1 basketball hoop per group; a stopwatch/timer

SET UP:
Select a shot that shooters can comfortably make 80% of the time. For example, elite shooters might take mid-range or threes, while lesser skilled shooters might shoot from inside the key. Split the group up into small groups of 4-5 players.

HOW TO PLAY:
One person in the group is standing near the basket without a ball, ready to rebound while the remainder of the group is standing in a line near the spot for the shot. The first person in line takes their shot, attempting to score. If they score, it counts as 1 point for the group. If they miss, no points are awarded. The rebounder then collects the ball and goes to the end of the line to wait their turn, while the next person in the line takes their shot. The person who shoots becomes the rebounder, and the rotation repeats.

Once the rules of the game are explained, the teams are then told that they will hold their breath for the duration of the round *(performer and task constraint)*. As soon as the round begins, all people in all teams hold their breath and begin to play. As soon as any individual needs to breathe they simply remove themselves from the play and can no longer participate in that round. They can't become the rebounder, they are out. When the last person in their team needs to breathe, they are done with the round. NOTE: no extra points for passing out. Expressing the importance of safety of crucial.

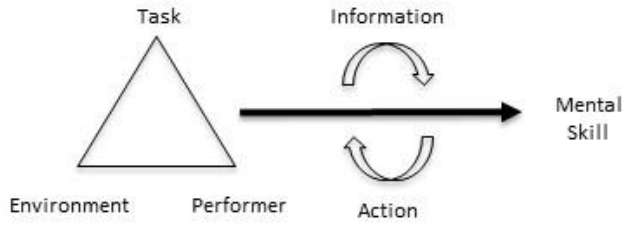
Be sure to time the round for how long it takes. Each team should keep track of their own points.

Mid-way debrief (after the first round): What was it like? How did it feel? Why was it hard? How many points did you score? (Typical answers: "It was hard to focus because I was focusing of how I felt;" "I felt rushed;" etc.). This is a good time to reinforce that when you don't use your breath to your advantage, it's easy to put your mind on the wrong things, rush mistakes, or feel sped up. *Take this time to introduce diaphragmatic breathing.*

Now, play the round again, but each time before they shoot *(information)*, they have to take a diaphragmatic breath *(action)*. No more holding their breath. If they don't take the breath, the shot doesn't count. Be sure to play the round for the same amount of time it took the first round, to keep it fair.

DEBRIEF:
Ask questions to solicit their experience: "How was that different?" "What did it feel like?" (Typical answers: easier, more relaxed, more focused.) This is a good time to reiterate how the breath can help manage focus and facilitate more effective thinking. Also, ask how many points they scored. Almost always, they scored more points. einforces the breath in enhancing performance.

SESSION FIVE

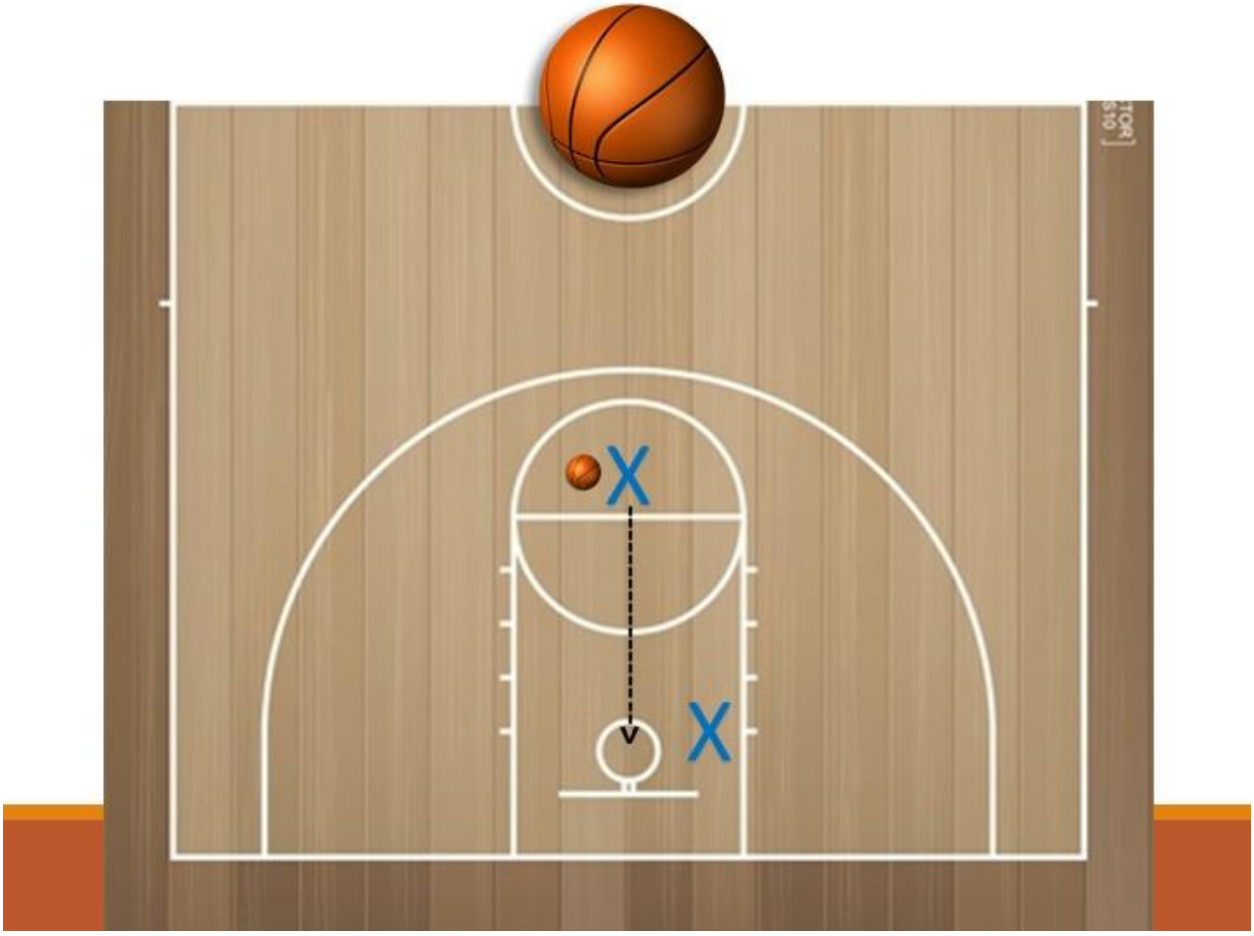


EXERCISE: In the Bank

SKILL: Breathing

COUPLING: Pressure distractions + breathing

CONSTRAINT: Task and environment



SESSION FIVE: IN THE BANK

PURPOSE:
To reinforce effective breathing to manage productive thinking and focus at various levels of pressure.

OBJECTIVE:
Make free throws. First person to reach 100 points loses.

MATERIALS:
One ball, one basket

SET UP:
Players will alternate shooting from the free throw line. Rotate after each shot.

HOW TO PLAY:
Task constraint: At the beginning of the game, there are 10 points "in the bank." The first person shoots from the free throw line. If a person makes the shot, 10 points get added to the bank and the shooter doesn't collect any points. If the shooter misses, they collect all the points that are in the bank and the bank resets at 10. Shooters alternate after each shot, attempting to make their shots so they do not collect any points. The points they do collect are added until someone passes 100 points First person to pass 100 loses.

For example, if the first person misses the shot, the person "collects" the 10 points, and it's the next person's turn to shoot. Another 10 points go into the bank. Alternatively, if they make the shot, the shooter does not collect any points and another 10 points get added to the bank. Now there are 20 points in the bank and it's the next shooter's turn. If that shooter misses, they collect all 20 points and bank resets at 10.

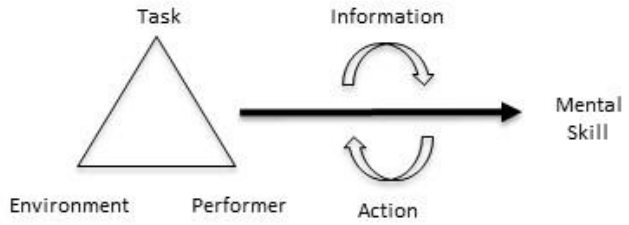
Prior to each shot *(information)*, the shooter is required to take a breath *(action)* before shooting.

Round 1: 1 on1
Players are paired off and compete against on other person.

Round 2: team
Players are split into two teams and the team rotates through players. Everyone on the team watches each shot throughout the round *(environment constraint)*.

DEBRIEF:
Explore how they players' experience differed between a low value shot and high value shot. Discuss how the breathing impacted their focus or thinking when the shots were high in value. Further explore how the introduction of spectators impacted their thoughts and focus.

SESSION SIX



EXERCISE: Rack 'em up

SKILL: Self-talk

COUPLING: Expectation distraction + verbal cue

CONSTRAINT: Task

SESSION SIX: RACK 'EM UP

PURPOSE:
To establish awareness of thinking patterns and introduce self-talk as a skill to manage focus and facilitate more effective thinking.

OBJECTIVE:
Score as many baskets as possible before missing three shots.

MATERIALS:
Basketballs and hoops, depending on number of people

SET UP:
Split people into groups of 2-4, each with a ball and a access to a hoop

HOW TO PLAY:
One player will go at a time, taking a shot from a designated area, dependent on the skill of the team. For example, if the team is skilled and capable of consistent 3-point shots, that is a suitable option. Alternatively, a mid range shot can be selected. The player with the ball shoots. The shooter can shoot from any place on the court the fits the designated shot. For example, if the shot is mid-range, they can choose any mid-range shot on the floor. If the shot is designated as a 3-point shot, they can shoot from anywhere outside the 3-point line. Group mates in the exercise rebound for the shooter.

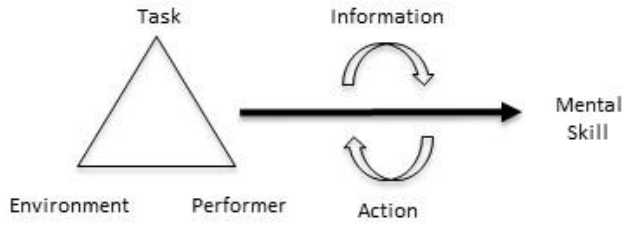
If they make it they shoot again. If they miss, they shoot again. However, after they miss the third shot, their turn is over. Their total score is that number of shots they scored during the exercise before they miss their third shot.

Once everyone in the group has gone, take the opportunity to debrief what they were thinking about during the exercise. How did their shots shift when they missed a shot knowing they could take another one compared to when they knew they only had one miss left? What were they focusing on? Take this time to introduce verbal cues as a reset tool to manage the unproductive thinking and focus on what's important or productive.

Task constraint: After everyone has identified a verbal cue, play the round again, this time with the shooter having to use their verbal cue *(action)* before each shot *(information)*.

DEBRIEF:
Use your focus cue to manage your thinking and focus to reset from mistakes and to manage expectations.

SESSION SEVEN

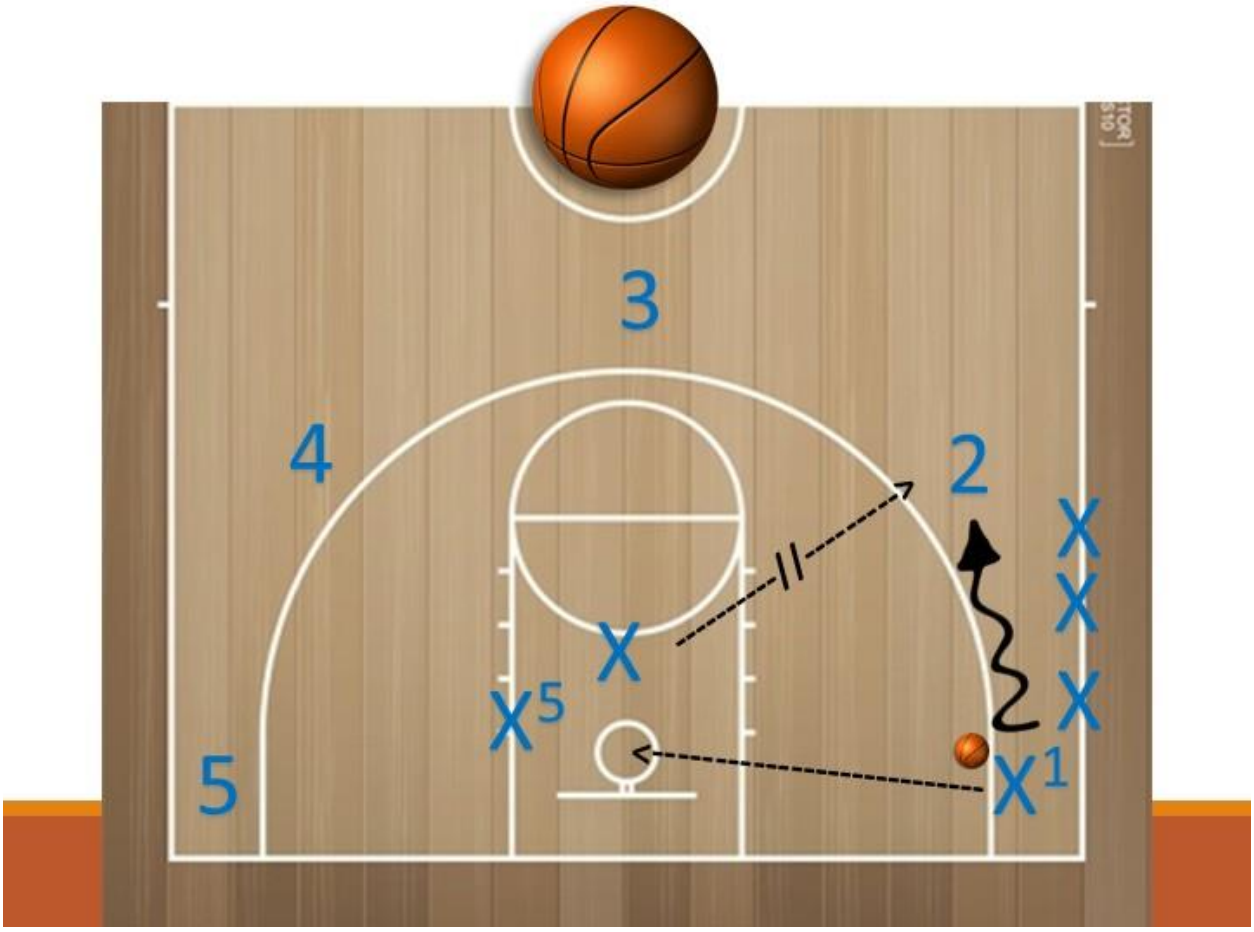


EXERCISE: 10 Up

SKILL: Self-talk

COUPLING: Pressure + verbal cues

CONSTRAINT: Task, environment



SESSION SEVEN: 10 UP

PURPOSE:
To challenge players to use their verbal cue in time pressured moments to help them be ready for their shot when their moment arrives.

OBJECTIVE:
First team to score to 10 shots, counting by ones, at all 5 spots.

MATERIALS:
Half court, one ball per team

SET UP:
Split the group into 1 teams. Two teams will play at a time.

HOW TO PLAY:

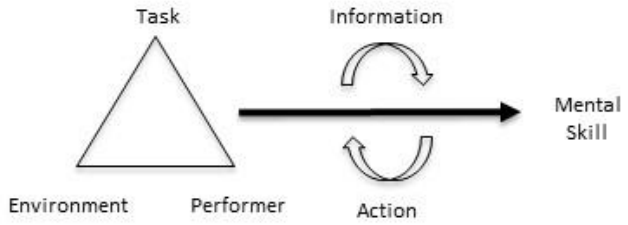
Round 1: As soon as the game begins, the first player in the team shoots the ball from the corner. The shooter rebounds their ball and goes back to the end of the line. If the shooter misses, the next person shoots; if they make it, they count the number 1 out loud indicating the successful shot. The next person shoots and with each made shot, one by one, they count until 10 shots are made. The first team to score 10 shots from the sport gets the point. Both teams then advance along the 3-point line to the wing for shot 2. This pattern continues through all 5 shot spots. After the 10th shot is made from the 5th and final spot, The game is over. Whichever team one the most rounds wins.

Once there is a winner, take the opportunity to debrief what they were thinking about during the exercise. How did their shots shift when the other team was scoring or when their own teammates were watching? What were they focusing on? Take this time to reinforce verbal cues as a tool to manage any unproductive thinking and focus on what's important or productive.

Task constraint: After everyone has identified their verbal cue, play the round again, this time with the shooter having to use their verbal cue *(action)* before each shot *(information)*.

DEBRIEF:
Explore how people used their cues, when it worked, and how it impacted their ability to mentally resent their thinking and focus in the moment.

SESSION EIGHT

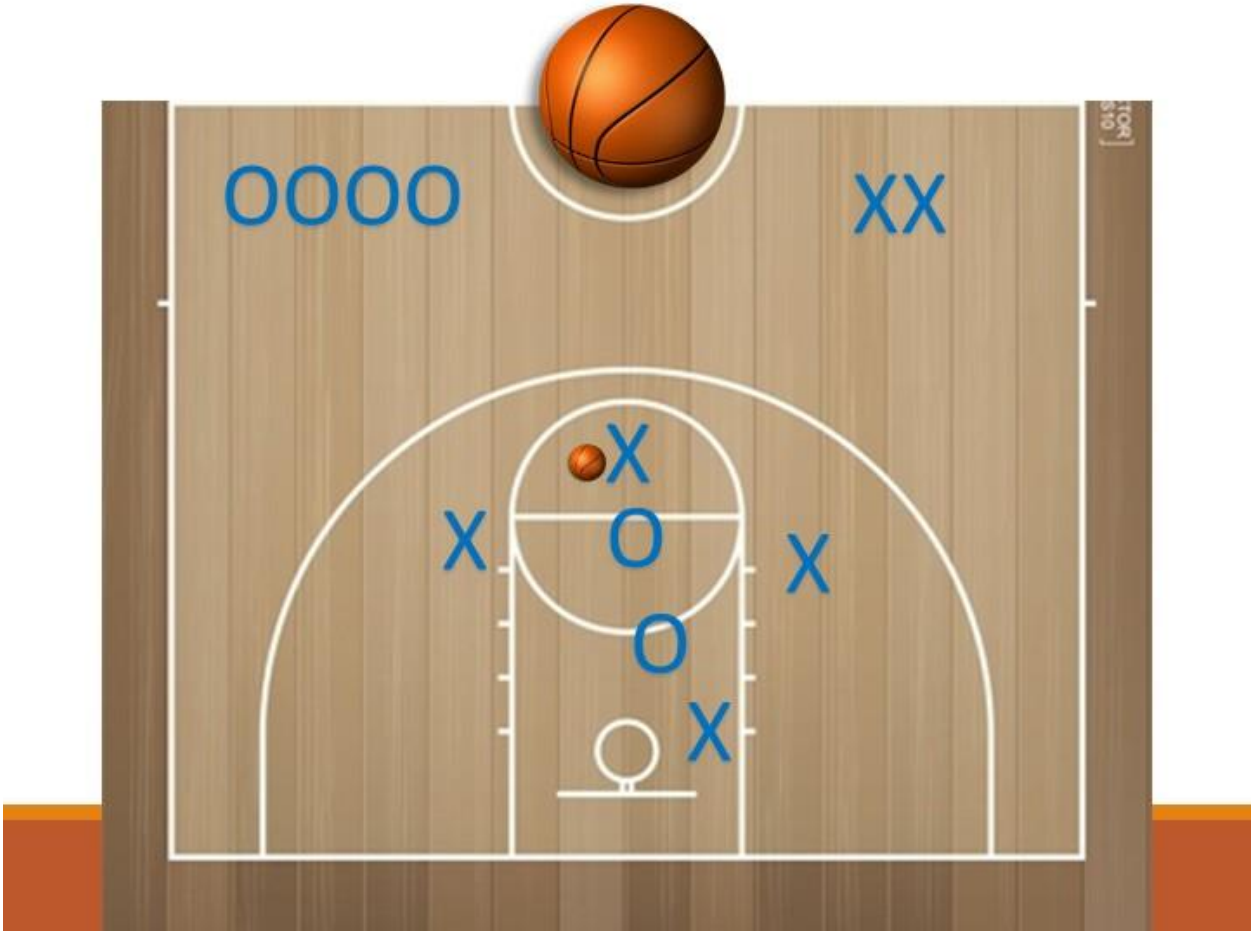


EXERCISE: Whatever It Takes

SKILL: Focus

COUPLING: Emotional distractions + mental strategy

CONSTRAINT: Task



SESSION ONE: WHATEVER IT TAKES

PURPOSE:
To put the players in an environment of setbacks where focus and negative thinking will be easily elicited, and see how they respond.

OBJECTIVE:
First team to score 7 points wins. Points are scored for a made shot (counting by ones) or a defensive rebound.

MATERIALS:
Half court, basketball, 2 dice

SET UP:
Split the group into two teams. Have one die for each team.

HOW TO PLAY:
Task constraint: To start the game, roll both dice. The number that shows up on the die is the number of players that the team can send out for that round (up to 5). So, if one die rolls a 2 and the other die rolls a 4, one team will get 2 players while the other team will get 4 players and they have to still play by the same rules to score.

Throughout the exercise, interrupt the game as desired. For example, call unfair fouls and turnovers. Whatever it takes. First team to 7 points wins.

DEBRIEF:
Highlight their response to the adversity. Ask what skills they used *(action)* to manage the frustration or difficulty *(information)* and bounce back. Demonstrate how their thoughts and emotions played a role in their performance and how they became distracted by unhelpful information.

VARIATION:
if a team roles an even number, they automatically get half the number of people as what they rolled. For example, if the team rolls a 4, instead of getting to send 4 people into the game, they only get to send 2 people into the game and they still need to complete the task. let individual players on the team roll the dice because they feel responsible for the outcome. It adds a little bit of pressure, a little bit of expectation, and a little bit of that letting your team down feeling into play. Gives good insight into player's approach or avoidance tendencies.

APPENDIX G: PRESENTATION SLIDES

Slides One and Two

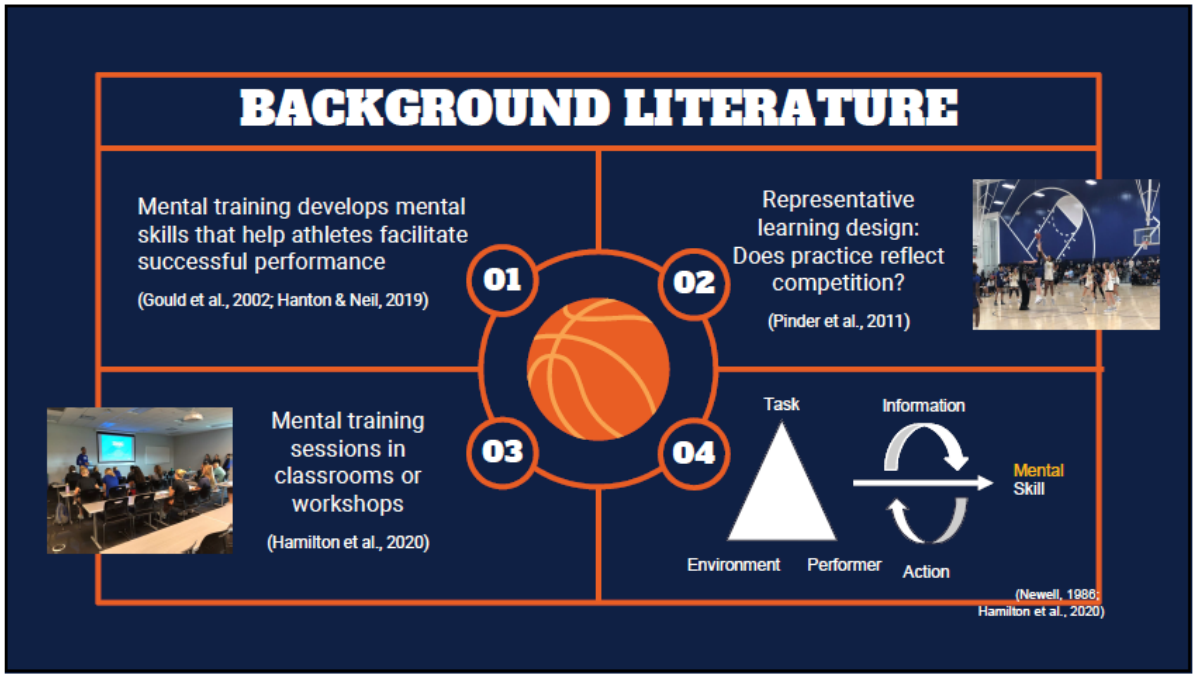
UNC GREENSBORO

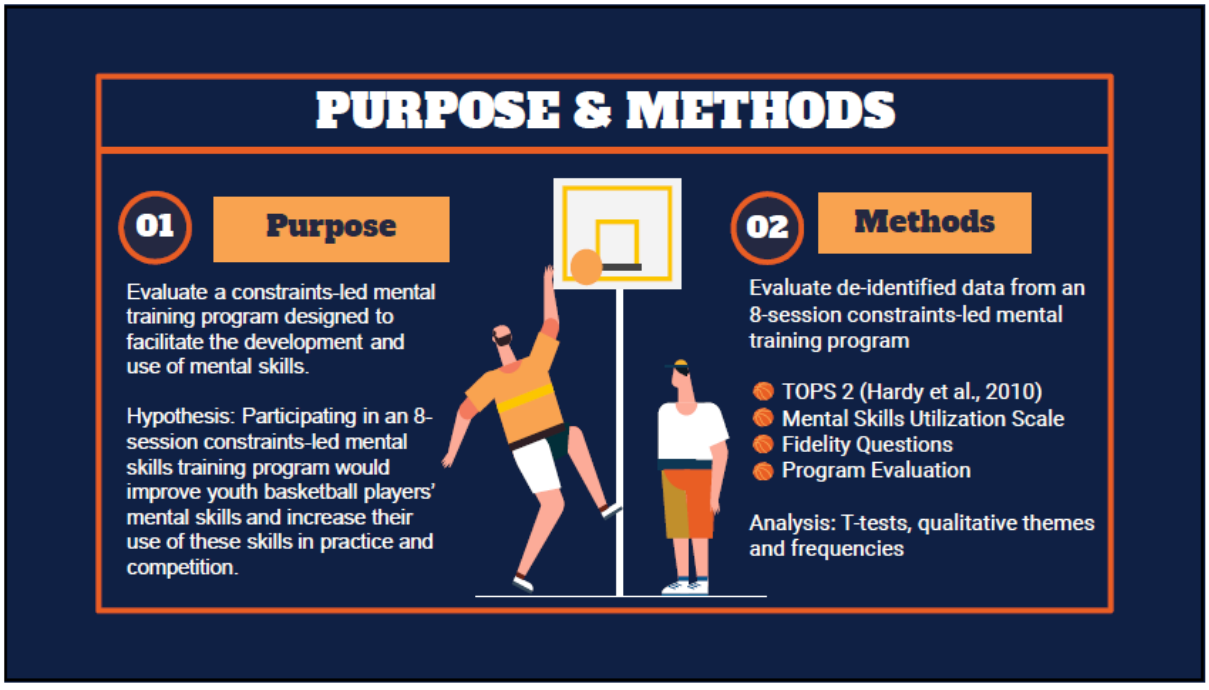
Train your brain the way you play:
A constraints-led approach to developing mental skills in sport

Lindsey Hamilton, EdD, CMPC
Head of Mental Performance
IMG Academy

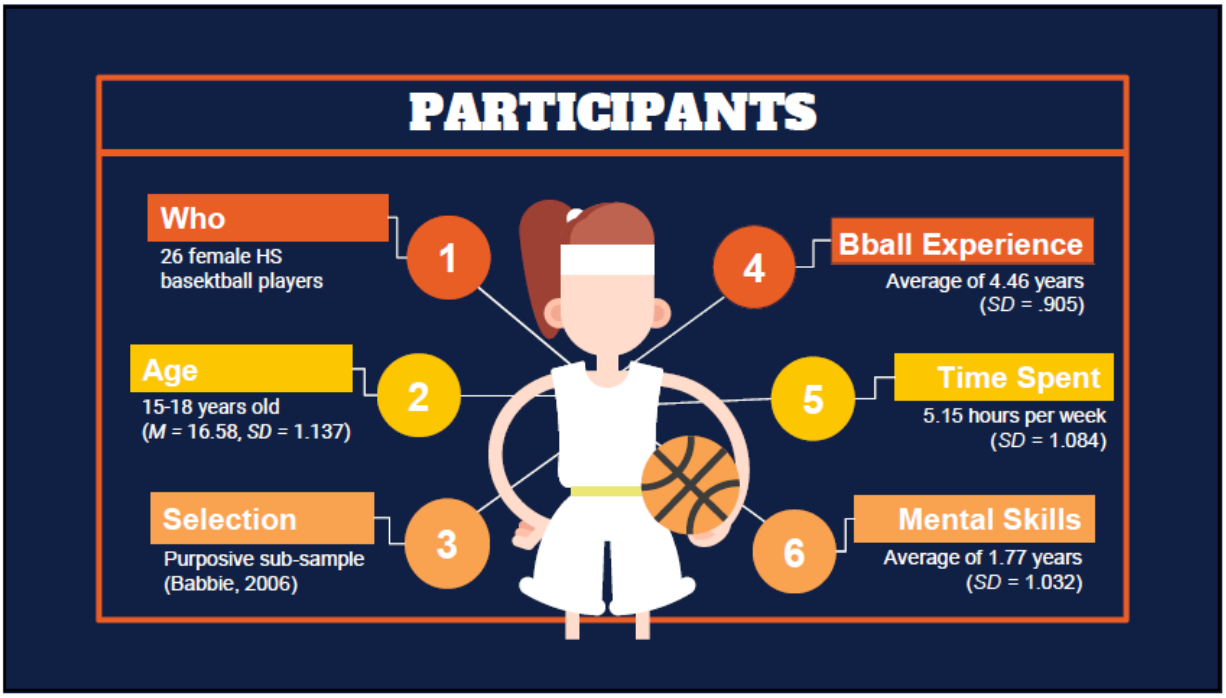
With Special thanks to:
Dr. Erin Reifsteck
Dr. Louisa Raisbeck
Dr. Diane Gill

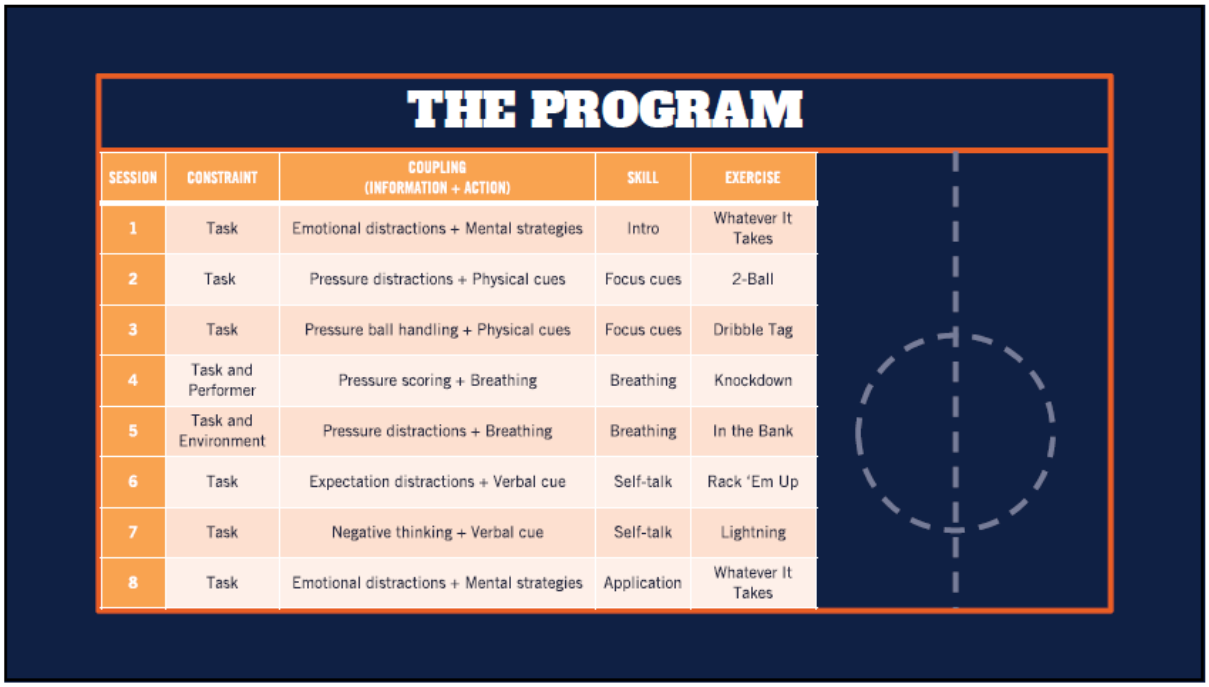
Slides Three and Four





Slides Five and Six





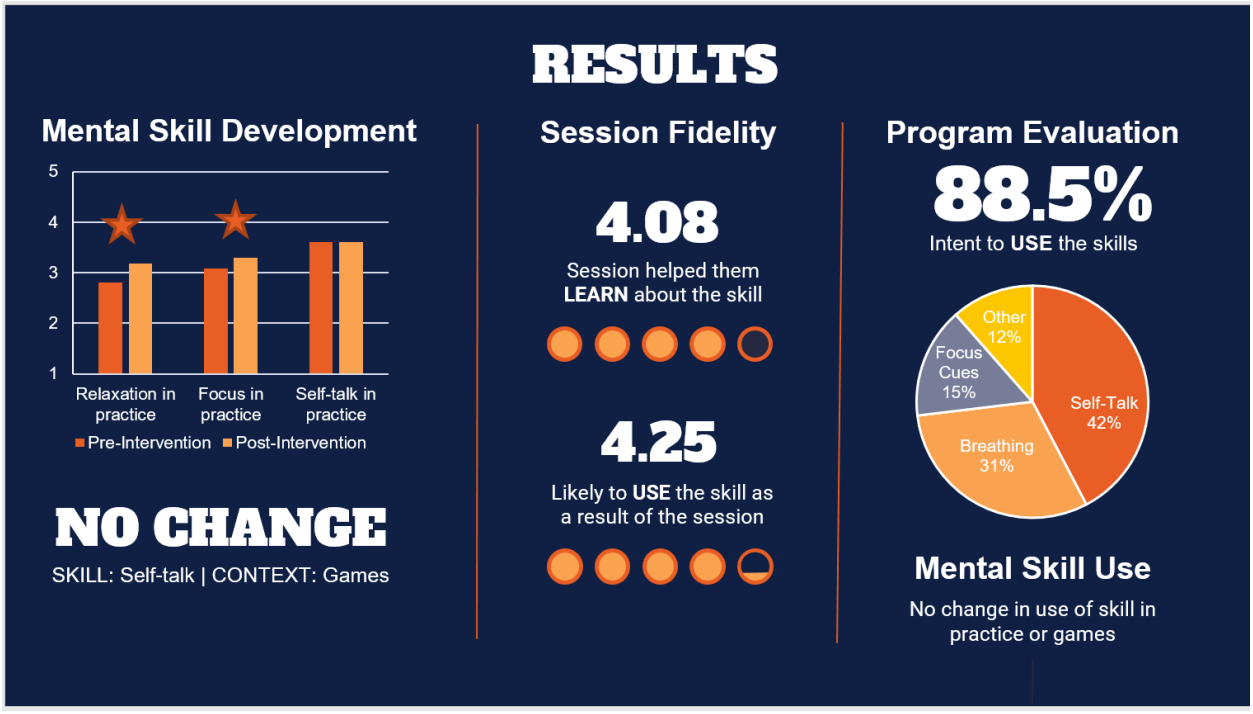
SESSION	CONSTRAINT	COUPLING (INFORMATION + ACTION)	SKILL	EXERCISE
1	Task	Emotional distractions + Mental strategies	Intro	Whatever It Takes
2	Task	Pressure distractions + Physical cues	Focus cues	2-Ball
3	Task	Pressure ball handling + Physical cues	Focus cues	Dribble Tag
4	Task and Performer	Pressure scoring + Breathing	Breathing	Knockdown
5	Task and Environment	Pressure distractions + Breathing	Breathing	In the Bank
6	Task	Expectation distractions + Verbal cue	Self-talk	Rack 'Em Up
7	Task	Negative thinking + Verbal cue	Self-talk	Lightning
8	Task	Emotional distractions + Mental strategies	Application	Whatever It Takes

Slides Seven and Eight

Let's practice!

Pressure scoring + Breathing

Slides Nine and Ten



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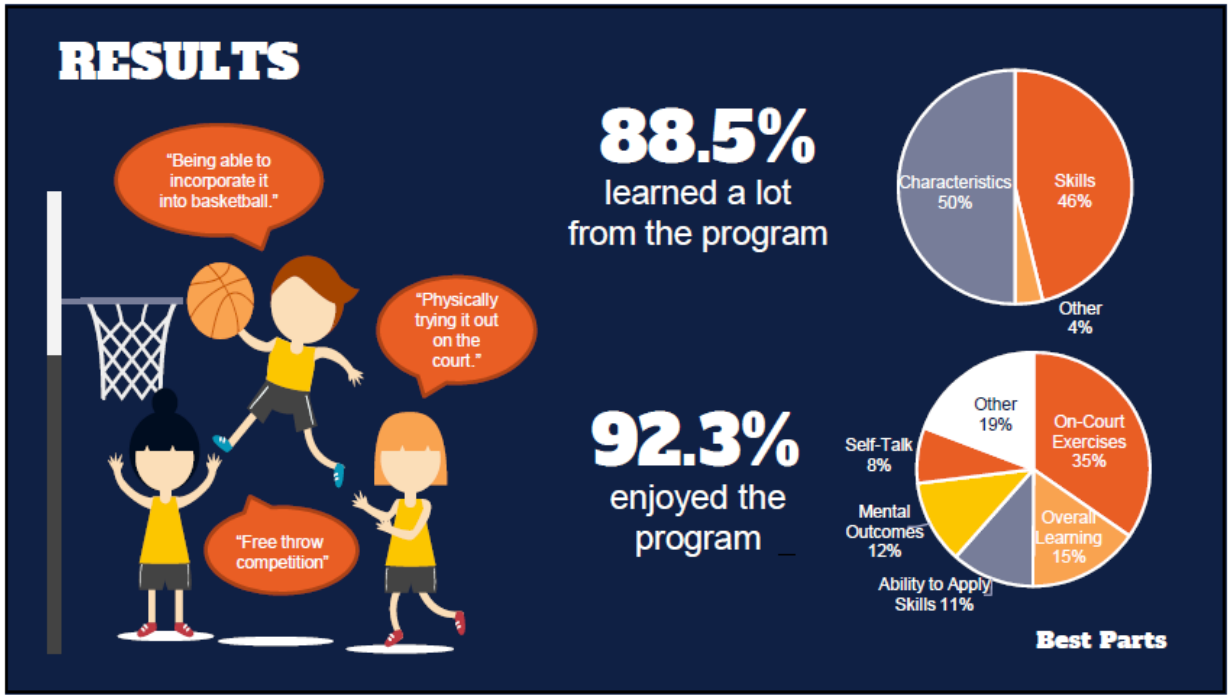

Slides Eleven and Twelve