The Effect of self-controlled practice on forearm passing, motivation, and affect in women’s volleyball players

Nels Rydberg

University of Nevada, Las Vegas

Follow this and additional works at: http://digitalscholarship.unlv.edu/thesesdissertations

Part of the Psychology of Movement Commons

Repository Citation

THE EFFECT OF SELF-CONTROLLED PRACTICE ON FOREARM PASSING,
MOTIVATION, AND AFFECT IN WOMEN’S VOLLEYBALL PLAYERS

by

Nels Rydberg
Bachelor of Science
California Polytechnic State University, San Luis Obispo
1993

A thesis submitted in partial fulfillment
of the requirements for the

Masters of Science Degree in Kinesiology
Department of Kinesiology and Nutrition Sciences
School of Allied Health Sciences
Division of Health Sciences

Graduate College
University of Nevada, Las Vegas
May 2011
THE GRADUATE COLLEGE

We recommend the thesis prepared under our supervision by

Nels Rydberg

entitled

The Effect of Self-controlled Practice on Forearm Passing, Motivation, and Affect in Women’s Volleyball Players

be accepted in partial fulfillment of the requirements for the degree of

Master of Science in Kinesiology
Department of Kinesiology and Nutrition Sciences

Gabriel Wulf, Committee Chair
John Mercer, Committee Member
Janet Dufek, Committee Member
Erin Hannon, Graduate Faculty Representative

Ronald Smith, Ph. D., Vice President for Research and Graduate Studies and Dean of the Graduate College

May 2011
ABSTRACT

The Effect of Self-Controlled Practice on Forearm Passing, Motivation, and Affect in Women’s Volleyball Players

by

Nels Rydberg

Dr. Gabriele Wulf, Thesis Committee Chair
Professor of Kinesiology
University of Nevada, Las Vegas

Motor learning research has suggested that self-controlled practice (or “autonomy”) leads to more effective learning of motor tasks. Debate continues, however, as to why. Most motor behaviorists maintain the better learning is due to cognitive and information-processing factors. Recently, others have proposed the learning enhancement is due to such psychological factors as motivation and affect. The present study sought to measure motor skill learning, intrinsic motivation, and affect in self-controlled versus externally-controlled (yoked) practice conditions.

Participants, 16 collegiate women’s volleyball student-athletes from two National Collegiate Athletic Association Division I programs, were paired by forearm passing skill level, and one of each pair was randomly placed in either the self-control or yoked group. The self-control participants were asked to design their own forearm passing drill during the practice phase of the experiment. The yoked participants followed the design established by the self-control participant to whom they were yoked. Each of the participants’ forearm passing accuracy was measured in a free ball passing drill consisting of a pre-
test and practice phase on Day 1, and a post-test on Day 2. Their intrinsic motivation was measured using the Intrinsic Motivation Inventory (IMI), and their positive and negative affect was measured using the Positive and Negative Affect Scale – Expanded Edition (PANAS-X). The IMI and PANAS-X were administered in a baseline condition (after a team practice one week prior to participation in the study) at the end of Day 1, and the end of Day 2.

Analysis of the data revealed no statistically significant differences between groups in either forearm passing, intrinsic motivation, or affect. Further research is needed to determine if intrinsic motivation and affect are partially responsible for the learning benefits of self-controlled practice.
AKNOWLEDGEMENTS

Thank you Julie for your love, prayers, support, and understanding through the research process. You helped me much more than you know. To Erin Hannon, Ph.D., thank you for your valuable insight regarding the psychological aspects of this study. To Janet Dufek, Ph.D., thank you pushing me in your class, for encouraging me to continue working hard, and for inspiring me with your hard work including on this project. To John Mercer, Ph.D., thank you for your thoughtful analysis of this thesis and for challenging me to think at a deeper level. Thank you all for agreeing to be a part of my thesis committee. To Gabriele Wulf, Ph.D., thank you for giving me the opportunity to work for and with you, and to become your friend. Your support and encouragement has meant very much to me and I look forward to further collaboration with you. Most importantly, thank you God, my heavenly King, for providing this experience and all I needed to accomplish my goals.
# TABLE OF CONTENTS

ABSTRACT ........................................................................................................ iii

ACKNOWLEDGEMENTS ................................................................................... v

LIST OF FIGURES ........................................................................................... vii

CHAPTER 1 INTRODUCTION ............................................................................ 1
  Purpose of the Study ...................................................................................... 5
  Hypotheses .................................................................................................... 5
  Definition of Terms ..................................................................................... 6
  Assumptions ............................................................................................... 7
  Limitations .................................................................................................. 7

CHAPTER 2 REVIEW OF RELATED LITERATURE ......................................... 9
  Self-Controlled Practice ............................................................................. 10
  Autonomy .................................................................................................. 12
  Positive Affect .......................................................................................... 14
  Forearm Passing ....................................................................................... 15
  Measures ................................................................................................... 16

CHAPTER 3 METHODOLOGY ......................................................................... 19
  Design Statement ....................................................................................... 19
  Participant Characteristics ........................................................................... 19
  Collection of the Data ................................................................................ 20
  Instrumentation ......................................................................................... 23
  Data Analysis ............................................................................................ 24

CHAPTER 4 RESULTS .................................................................................... 25
  Analysis of Data ........................................................................................ 25
  Statistical Analysis of Hypotheses ............................................................. 30

CHAPTER 5 SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS ............ 31
  Discussion of Results ................................................................................ 31
  Conclusions and Recommendations for Further Study ......................... 35

REFERENCES ............................................................................................... 38

APPENDIX I PANAS-X .................................................................................... 46

APPENDIX II IMI ........................................................................................... 47

APPENDIX III PARTICIPANT MEANS ............................................................. 49

APPENDIX IV IRB APPROVALS .................................................................... 51
LIST OF FIGURES

Figure 1  Passing Target Detail .............................................................................. 17
Figure 2  Graph of Passing Accuracy Scores .......................................................... 26
Figure 3  Graph of Positive Affect Scores ............................................................... 27
Figure 4  Graph of Negative Affect Scores .............................................................. 28
Figure 5  Graph of Interest Scores ......................................................................... 28
Figure 6  Graph of Value Scores ........................................................................... 29
Figure 7  Graph of Choice Scores .......................................................................... 30
Figure 8  Court and Target Dimensions ................................................................ 37
CHAPTER 1

INTRODUCTION

Sport psychology has traditionally focused on how motivation, affect, and performance are influenced by various factors. Motor behavior, meanwhile, has primarily focused on information processing and learning as a function of different practice conditions (Lewthwaite & Wulf, 2010). This study brings together motivation and affect from sport psychology, and learning from motor behavior in an effort to show the interdependence of the components. The autonomy (independence) of expert volleyball players was manipulated in a practice setting in order to measure its effect on the players’ learning of a forearm passing task, intrinsic motivation and affect.

It has been debated if coaching is both an art and a science (Nash & Collins, 2006); the science including the development of skills and performance, and the art including decision-making and the motivation of athletes. Regardless of its status as an art or a science, it is clear that a successful coach must develop athletes at many levels. The most obvious of these is physical development (Carter & Bloom, 2009). Teaching athletes to perform a skill using the most efficient and effective technique is obviously important, as is having the athletes learn and therefore remember how to use that technique. Internalizing the execution of skills with proper technique to the point of automaticity (not requiring conscious control) is best accomplished with the use of scientifically supported motor learning techniques.
Another important component of successful coaching is motivating athletes to practice, condition, and compete at a consistently high level (Carter & Bloom, 2009). Though many coaches tend to use extrinsic motivation, it has been shown that intrinsic motivation is the single-most effective type of motivation (Jowett, 2008). Furthermore, several studies have demonstrated that intrinsic motivation is influenced by other factors such as positive affect and autonomy (Gillet, Berjot, & Rosnet, 2009; Gillet, Vallerand, Amoura, & Baldes, 2010; Hodge, Lonsdale, & Jackson, 2009; Isen & Reeve, 2005; Lutz, Lochbaum, & Turnbow, 2003). Though certainly related, these components have rarely been combined and addressed simultaneously.

Motivation has also recently been shown to have direct positive effects on learning. In a study of the effect of social-comparative feedback, Lewthwaite and Wulf (2010) found that those participants who were told (regardless of performance) their performance was better than “average,” displayed better learning of a novel balance task than those who were told their performance was below average, or the control group who was not given any comparative feedback. The findings suggest the motivational variables of the social-comparative feedback led to more effective learning. Research concerning self-controlled feedback (Chiviacowsky & Wulf, 2005) revealed that participants preferred receiving feedback after good trials rather than poor ones, and that those who received this positive feedback learned a throwing task better than those who did not. This implies that a more positive learning experience (receiving feedback after good trials) enhances learning due to its motivational
effects. Therefore motivation may affect not only effort level, but the ability to learn as well.

The importance of intrinsic motivation and autonomy was proposed by Deci and Ryan in their self-determination theory (SDT; 1985; Ryan & Deci, 2002). SDT is “a macro-theory of motivation, personality and optimal functioning” (Deci & Vansteenkiste, 2004, p. 23). SDT suggests people all have three basic psychological needs: autonomy, competence, and social relatedness. Further, these basic needs are positively related to motivation, self-regulation, and well-being. For example, as a person’s perception of external support for their autonomy increases, so will their intrinsic motivation.

Intrinsic motivation, autonomy, self-determined motivation, and positive affect, all of which are aspects of SDT, are of particular importance to the current study. SDT proposes that intrinsic motivation is important to successful performance (Deci & Ryan, 1985; Ryan & Deci, 2002). It should be noted that performance and learning are different. Performance is shown at the current time such as during the acquisition phase of learning a new task. Learning is measured after practice has ended and a day (or more) has passed. This so-called retention test (a delayed post-test) is commonly used in motor behavior research to measure the amount of learning that has occurred.

SDT also posits a person’s perception of support for autonomy in a given situation will increase his or her intrinsic motivation. Self-determined motivation, a phrase used in SDT literature, is a combination of intrinsic and varied extrinsic sources of motivation, but intrinsic motivation is a crucial element of self-
determined motivation (Deci & Ryan, 1985; Ryan & Deci, 2002). Additionally, in a study of SDT, Isen and Reeve (2005) found that positive affect fosters intrinsic motivation.

All of the relationships between these different factors lead to the rationale for this study. First, providing self-control participants with the opportunity to design their own passing drill will create for them an autonomous environment. As mentioned above, according to SDT, this type of autonomy has a positive correlation with increased intrinsic motivation in the participants. Furthermore, one’s perception of autonomy is positively related to positive affect (Sheldon, Ryan, & Reis, 1996), and positive affect has a positive relationship with intrinsic motivation (Isen & Reeve, 2005).

SDT indicates intrinsic motivation is associated with superior performance, including motor performance (Gillet et al., 2009; Gillet et al., 2010). It seems reasonable then to predict intrinsic motivation is also associated with superior learning (Chiviacowsky & Wulf, 2005). The main purpose of this study is to test this hypothesis. It is hypothesized that given autonomy, self-control participants will display superior learning, greater positive affect (and less negative affect), and higher levels of intrinsic motivation than those who are not given autonomy. Aside from its potential theoretical importance, the results of this study might lead to application in that coaches may gain another way in which to enhance the intrinsic motivation of their athletes.
Purpose of the Study

Though past studies in education (Reeve, Jang, Carrell, Jeon, & Barch, 2004) and exercise (Edmunds, Ntoumanis, & Duda, 2008) settings have shown that teachers can learn to become more autonomy-supportive, thus improving their students’ performance, “further intervention studies in the sport domain are still needed to extend these findings to the coaching context” (Gillet et al., 2010, p. 160).

This study will add to research regarding autonomy-supportive learning environments, specifically in sport. Though autonomy has previously been shown to be positively related to sport performance, this appears to be the first study to measure the effect of autonomy on learning. This study also addresses a new direction in motor behavior investigations regarding the “social-cognitive-affective-motor nature of motor behavior” (Lewthwaite & Wulf, 2010, p. 1). This new direction is, in other words, examining psychological influences on motor behavior.

Hypotheses

Hypothesis #1

After being given the opportunity to design and participate in their own forearm passing drill, the self-control (experimental) group will display greater intrinsic motivation than the yoked (control) group.
Hypothesis #2

The self-control group will achieve higher (more accurate) scores on the retention test than the yoked group.

Hypothesis #3

The self-control group will display greater positive affect after manipulation than the yoked group.

Definition of Terms

The following definitions are given for the purpose of clarification:

Autonomy: “To engage in activities of one’s choosing and to be the origin of one’s own behavior” (Edmunds et al., 2008, p. 375).


Intrinsic Motivation Inventory (IMI): “A multidimensional measurement device intended to assess participants’ subjective experience (including intrinsic motivation) related to a target activity in laboratory experiments” (Ryan, 1982).

Negative affect: “Subjective distress that subsumes a broad range of aversive affects including fear, nervousness, guilt, and shame” (Phen, Allen, and Katz, 2007).

Positive affect: “The extent to which a person feels enthusiastic, excited, active, and determined” (Phen et al., 2007).
Positive and Negative Affect Scale – Expanded Form (PANAS-X): A questionnaire designed to measure positive affect, negative affect, and 11 specific affects (Watson & Clark, 1990).

Assumptions

The following assumptions guided this study:

People who are given greater autonomy will report higher levels of intrinsic motivation on the IMI.

People who are given greater autonomy will report higher levels of positive affect (and lower negative affect) on the PANAS-X.

People who are given greater autonomy will report higher levels of intrinsic motivation and positive affect, and will display superior learning than those who are not given autonomy.

Limitations

One possible limitation to this study is the reliability of the proposed passing accuracy rating. Though the rating system is based on the common 3-point system used by a great majority of coaches in this country over several decades, the proposed 6-point system is untested. One factor to be considered is that the 3-point system is largely subjective and does not lend itself to research while the 6-point system is objective in terms of the location of the pass but not the trajectory (tempo) of the pass which remains subjective. The use of video to
record the passes will allow the tempo of the passes to be evaluated by experts who are blind to the purpose of the study.

Another limitation to this study is that the researcher anticipates including 30 participants due to participant requirements. That is a relatively low participant number compared to most studies utilizing questionnaire data. There is also the possibility that not all 30 participants will be able to participate. A further reduced participant number may affect the findings.
CHAPTER 2
REVIEW OF RELATED LITERATURE

If a coach seeks to maximize the success of athletes in sport, s/he must enhance, among other factors, the athletes’ performance and motivation. The performance most important to athletes’ success occurs during competition. This requires the athletes to acquire and/or improve skills and techniques during practice and retain them such that they are able to perform them at another time against an opposing team. Therefore, the performance coaches seek reflects the more permanent effect of learning. For an athlete to perform and learn effectively in both practice and competition requires strong, sustained effort. The required effort comes as a result of the athlete being motivated for such hard work, and also has the benefit of enhancing learning (Lewthwaite & Wulf, 2010; Chiviacowsky & Wulf, 2005). Following is a review of previous research in these crucial areas.

One interesting potential complication is that training and instruction (necessary to promote learning) have been shown to exert a significant negative effect on athletes’ autonomy, the latter of which tends to promote motivation and learning. Hollembeak and Amorose (2005) propose that this may occur because a coach who is providing a great deal of instruction may not be giving the athletes an opportunity to contribute to the planning and design of practice. The involvement of athletes in some of these decision-making processes is crucial for many reasons discussed below.
Self-Controlled Practice

Recent motor behavior research has examined self-controlled practice. The allowance of some measure of self-control results in enhanced learning compared to a prescribed practice plan (Wulf, Shea, & Lewthwaite, 2010). First studied by Janelle and colleagues (Janelle, Kim, & Singer, 1995; Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997), self-controlled practice has led consistently to better performance and learning when compared to participants who, all other things being equal, were not given the opportunity for self-control in their practice. The elements of practice controlled by participants in the experimental groups has varied while rendering similar positive results regardless of task. Janelle and his fellow researchers (1995; 1997) allowed the self-control participants to choose when they would receive feedback regarding their non-dominant arm throwing movement form. Their learning, measured in a retention test four days after acquisition, of the movement form and their accuracy scores were significantly higher than those in the control (“yoked”) group who received feedback about their performance after the same trials as the self-control participant with whom they were paired (yoked). Janelle et al.’s throwing study differs from the current study in two important ways. The throwing study used novice instead of expert performers, and no measures were utilized in an attempt to determine the source of improved learning (i.e., intrinsic motivation and/or positive affect, etc.) in the self-control group.

Other studies have found similar results allowing self-control of feedback during sequential timing tasks (Chen, Hendrick, & Lidor, 2002; Chiviacowsky &
Wulf, 2002), and for children in learning a throwing task (Chiviacowsky, Laroque de Medeiros, Kaefer, & Wulf, 2007). Additionally, self-control of the use of assistive devices while performing a balance task (Hartman, 2007; Wulf, Clauss, Shea, & Whitacre, 2001; Wulf, Lauterbach, & Toole, 1999), and self-control of the use of demonstration videos (Wulf, Raupach, & Pfeiffer, 2005) also resulted in superior learning.

There is clearly a learning advantage for those who are allowed to control elements of their practice. The current study concerns itself with the fact that explanations as to why this advantage occurs are still being debated. A common view of the benefits is that the participants, more involved in the process of learning, are more likely to increase their effort when learning the task (Ferrari, 1996). Another perspective suggests the self-control participants utilize more in-depth information processing during practice (Wulf et al., 2010). Chiviacowsky and Wulf (2002; 2007) proposed the benefits may be due to participants’ needs being met by choosing to receive feedback after relatively successful trials. An aspect that may be in common to these ideas is motivation.

Many authors have suggested that self-controlled practice is motivating to the learners (Bandura, 1993; Boekaerts, 1996; Chiviacowsky & Wulf, 2005; Wulf et al., 2010) but it appears as if the motivation created by self-controlled practice has yet to be measured with learning. Furthermore, the effects of self-controlled learning have been studied in novices but not in experts. This may be due to the fact that learning gains are usually smaller and therefore more difficult to measure in experts. However, the benefits may in fact extend to experts as well.
given that they have the opportunity to challenge themselves appropriately to enhance learning and effort (Patterson & Carter, 2010).

Autonomy

Most sport experts are found in coaching rather than teaching settings. Self-controlled practice provided by coaches has commonly been studied in regard to the basic psychological needs put forward by SDT and is therefore referred to as autonomy. Autonomy is critical to intrinsic motivation (Ryan & Deci, 2000) and has been found to be more important than the other basic psychological needs of competence and social relatedness (Mouratidis, Lens, & Vansteenkiste, 2010) in fostering that intrinsic motivation. Coaches can meet athletes’ needs for autonomy by providing options (Reinboth, Duda, & Ntoumanis, 2004) similar to those found in self-controlled practice. Researchers have measured significant increases in intrinsic motivation as a result of autonomy support in sport settings. Intrinsic motivation has, in turn, led to greater performance.

Gillet, Berjot, and Gobancé (2009) conducted a prospective study with 90 13- and 14-year old tennis players competing at the national level. The study utilized measures of motivation, basic psychological needs (autonomy, competence, and social relatedness), and performance over a three year period. Participants completed questionnaires prior to the first season’s competition. Their success during two consecutive seasons was measured using wins and losses. Prior to the third season, the participants completed the questionnaires once more and again their on-court success was tracked for a third season. The data revealed a
significant positive correlation between self-determined (primarily intrinsic) motivation and better performance, and between autonomy and self-determined motivation. Gillet and colleagues did not, however establish cause and effect or control for the amount of autonomy provided to the athletes by their coaches. It is possible that coaches provided greater autonomy to more successful athletes.

In a study involving elite athletes from various sports, Hodge and colleagues (Hodge, Lonsdale, & Jackson, 2009) measured the athletes’ basic psychological needs (autonomy, competence, and social relatedness), athlete engagement (AE), and dispositional flow (flow). The authors define AE as, “a persistent, positive, cognitive-affective experience in sport that is characterized by confidence, dedication, enthusiasm, and vigor” (Hodge et al., 2009, p. 187). Hodge et al. described Csikszentmihalyi’s (1990) idea of flow as, “an intrinsically rewarding, state-like experience characterized by total involvement or immersion in an activity” (Hodge et al., 2009, p. 187). AE and flow fit nicely with both intrinsic motivation and positive affect (to be discussed later). The study’s results found that needs satisfaction, including autonomy, predicted both AE and flow.

Similar research was conducted at a national judo tournament (Gillet et al., 2010). Prior to the beginning of competition, the participants completed questionnaires measuring their autonomy and motivation. The researchers then tracked their performance in the tournament in terms of wins and losses. The amount to which the judokas perceived that their coach(es) provided them with an autonomous environment, their self-determined motivation and success in the tournament was facilitated.
Given the research mentioned above, it has been clearly demonstrated that autonomy is associated with increases in intrinsic motivation and performance. Research in this area has apparently not, however, measured the relationship between autonomy, intrinsic motivation and the learning of motor skills. The current study will address these components.

Positive Affect

Positive affect is another psychological measure that is closely related to both autonomy and intrinsic motivation. For example, Lutz and collaborators conducted research with college-age participants enrolled in an exercise class (Lutz, Lochbaum, & Turnbow, 2003). They found that the perceived autonomy of the participants during exercise significantly predicted their positive affect following the exercise bout. In other research, an investigation of the relationships between students’ academic performance, motivation, and well-being revealed that intrinsic motivation was positively associated with positive affect (Burton, Lydon, D’Alessandro, & Koestner, 2006). Given Burton et al.’s findings, it is interesting to note that Isen and Reeve (2005) found participants in a manipulated positive affect condition displayed greater intrinsic motivation than participants in neutral conditions. In summary, autonomy is positively correlated with positive affect (Lutz et al., 2003), autonomy is positively correlated with intrinsic motivation (Ryan & Deci, 2002), intrinsic motivation is positively correlated with positive affect (Burton et al., 2006), and positive affect promotes intrinsic motivation (Isen & Reeve, 2005).
In the present study, participants were provided with the opportunity to take part in self-controlled practice by allowing them to choose their own forearm passing drill design. Data collection involved a forearm passing accuracy rating, and questionnaires with which to measure the participants’ intrinsic motivation and positive affect. Each of these components deserves further discussion.

Forearm Passing

The choice of task for this study was based on its importance to the sport of volleyball. Though an overhead pass (commonly used to set a hitter) is sometimes utilized, the forearm pass is the primary skill used to receive a serve. For a team to be successful in a match, they must side out (win a rally initiated by the opponents’ serve) better than 60% of the time. The first step to siding out is the pass. If the first contact (the pass) is good, the second contact (the set) is more likely to be effective, and the third contact (the attack) is more likely to be successful in achieving a kill (an attack that cannot be returned by the opponents).

Research in the sport of volleyball strongly supports these claims. Analyzing the 2004 Olympic Games in Athens, Zetou, Moustakidis, Tsigilis, and Komninakidou (2007) found that, statistically, perfect and near-perfect passes were key to teams’ success in matches. That is true because, for elite players, set quality depends on pass quality, and attack quality depends on set quality (Daniel & Hughes, 2003). This is further explained by Florence (2008) when she states, “sequences of hits followed a first-order Markov chain, where the quality
of each hit depended only on the quality of the previous contact and not explicitly on contacts further removed in the sequence" (p. 1)

Measures

In organized volleyball from middle school to elite international competition, most teams utilize what is referred to as the 3-point scale (actually a four point scale as it includes zero) to measure passing accuracy. In that system, a “3” is a great pass from which the setter can set all of the offensive options. A “2” is a good pass that allows the setter to set a high outside (left side) or high back (right side) with consistency. A “2” is typically not an accurate enough pass to allow the setter to deliver a good set to the middle or “quick” hitter regularly. A “1” pass is essentially a ball that is merely kept in play and results in a set to the left side at best, or a free ball (passed or set to the other team rather than attacked) at worst. A “0” is either an ace for the serving team or an overpass in which the ball travels directly over the net back to the serving team.

I did not think this measure would be sensitive enough for the study, so I utilized a 7-point scale (including zero) based on the 3-point scale described above. In this new scale, a “6” is a perfect pass that passes through the center of the target (see Figure 1). A “5” is a great pass that contacts any part of the face of the target other than the center. A “4” is a really good pass that does not contact the face of the target but is within the first semicircle (see Figure 8). A “3” is a good pass that does not reach the first semicircle but lands in the second semicircle. A “2” pass is one that is playable by the passer’s team but does not
reach the second semicircle. A “1” is an overpass that lands in bounds on the opponents’ half of the court. A “0” is a ball that is not playable by others in that it either falls straight to the ground, hits an antenna (out of bounds) or the net or standard outside the antenna, or travels far enough behind or to the side of the passer such that another player would not be able to keep the ball in play. The tempo (or trajectory) of the passes was not measured. Expert volleyball players are unlikely to attempt or gain a benefit from passing a ball with a different trajectory than is typically used in a match because that is how they practice the skill. If the tempo of a pass was in question, the experimenter noted the trial number to allow for later evaluation of the videotape.

![Figure 1. Detail of the Passing Target](image)

Intrinsic motivation was measured using the Intrinsic Motivation Inventory (IMI) questionnaire (Ryan, 1982). The participants rated sentences about their experience in the passing drill on a Likert Scale from 1 (not at all true) to 7 (very
true). Examples of the sentences include: “I enjoyed doing the passing drill very much,” “I believe I had some choice about doing this passing drill,” and, “I think this is an important drill” (see Appendix I).

To measure the participants’ positive and negative affect, the PANAS-X (Positive and Negative Affect Scale – Expanded Form; Watson & Clark, 1990) was used. This measure asks the participants to rate words using a Likert Scale from 1 (very slightly or not at all) to 5 (extremely) to indicate how much each word describes the way they feel at the time. Examples of words used to indicated positive affect are: attentive, determined, and enthusiastic, while examples of negative affect words are: nervous, hostile, and distressed (see Appendix II).

Allowing the participants to design the passing drill is significant. First, student-athletes, the participants in this study, typically do not have a say in how a drill is designed. That decision is usually made by the coach prior to practice based on his or her perception of what the team or individuals need to work on most. Therefore, this was likely to be a novel experience for them. Furthermore, the choices the participants were allowed to make are important to the drill. Where each ball is served and passed from changes the angle at which the passer must redirect the ball to the target and is therefore an important decision. Also, having the opportunity to change the drill at any time, the participants were able to remain in one zone of the court for an extra serve or more to experience a successful pass before moving on to the next. This may have had an impact on their positive affect and therefore their intrinsic motivation, and learning.
CHAPTER 3

METHODS

Design Statement

Participants were volunteers from two National Collegiate Athletic Association Division I women’s volleyball programs. Each team’s participants were ordered from most to least skilled at forearm passing based on the 2010 season’s passing statistics and their coaches’ rankings. Players were then paired with each being assigned randomly (based on their schedule and availability) to either the self-control or yoked condition. [A similar procedure was used by Hall, Domingues, and Cavazos in their baseball batting study (1994).] As a result, similarly skilled passers followed the same drill design. The higher rated passer was assigned (based on schedules) to the self-control group in three out of the eight pairs. For example, the first available of two similarly-skilled passers was assigned to the self-control group and designed and participated in her own passing drill. At a subsequent time, the second available (yoked) participant of the pair participated in the drill designed by the first. This pattern continued for all subsequent pairs.

Participant Characteristics

Participants were volunteers who were current members of two different collegiate women’s volleyball teams. The head coaches of these programs granted approval for the study as did the athletics compliance coordinators and
the Institutional Review Boards. The demographic characteristics of the exclusively female participants are listed in Table 1.

Table 1: Characteristics of the participants

<table>
<thead>
<tr>
<th></th>
<th>Total (N = 16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (meters)</td>
<td>1.78 ± 0.09</td>
</tr>
<tr>
<td>Age (years)</td>
<td>19.38 ± 1.50</td>
</tr>
</tbody>
</table>

Values are means ± standard deviations

Collection of the Data

Baseline

One week prior to the first day of testing, and following a volleyball practice session, the study was introduced and participants were asked to sign the informed consent form. Subsequently, they completed the PANAS-X and IMI. The questionnaires provided a baseline measurement of their positive affect and intrinsic motivation.

Day 1

On the testing days, participants came into the gymnasium individually. They were assured of confidentiality and told they would be participating in a forearm passing drill and completing the same two questionnaires as was done previously. Each participant was given a five-minute self-directed warm-up during
which they did not have access to a volleyball. Participants then completed a pre-test consisting of two tosses (one-handed underhand toss with topspin) from each of the three zones to each of the three zones for a total of 18 passes. The first six tosses came from zone 6 with the passer in zone 6, 5, and then 1. The next six tosses came from zone 1 with the passer in zone 1, 6, and then 5. The final six tosses came from zone 5 with the passer in zone 6, 5, and then 1.

Following the pre-test, the self-control participants were asked to design their own passing drill as they proceeded through it, making changes (within the established parameters) at any time during the drill. This phase, also completed on Day 1 was considered to be the practice phase. It was explained that they would be tested the following day in the same manner as the pre-test in which all three passing and all three serving zones would be included. The drill they designed consisted of 45 volleyballs, three passing zones, and three serving zones. The passing score and location from which each ball was served and passed was recorded. The drill was also videotaped to allow for further evaluation at a later time. Yoked participants followed the same procedures except they performed the drill designed by the self-control participant with whom they were paired. Following the drill, all participants filled out the PANAS-X and IMI questionnaires.

Day 2

On Day 2, all participants were again given a five-minute self-directed warm-up period during which they were not allowed to use a volleyball. They then participated in a post-test (retention) passing drill, the same as the pre-test,
consisting of two tosses from each of the three zones to each of the three zones for a total of 18 passes. The first six tosses came from zone 6 with the passer in zone 6, 5, and then 1. The next six tosses came from zone 1 with the passer in zone 1, 6, and then 5. The final six tosses came from zone 5 with the passer in zone 6, 5, and then 1. Their passing scores were recorded and the drill videotaped. They again filled out the PANAS-X and IMI questionnaires. Following the second testing session, the purpose of the study was explained and any questions answered.

Table 2: Summary of Data Collection

<table>
<thead>
<tr>
<th></th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>IMI, PANAS-X</td>
</tr>
<tr>
<td>Day 1</td>
<td>Pre-test, Practice, IMI, PANAS-X</td>
</tr>
<tr>
<td>Day 2</td>
<td>Post-test, IMI, PANAS-X</td>
</tr>
</tbody>
</table>

The consistency of the testing was addressed as follows. Tosses were made with the objective of maintaining consistency of tempo and location. Furthermore, within each of the three passing zones (5, 6, and 1) a square target area (2 x 2 m) was taped off. The center of the target areas were 5.5 m from the net and equidistant to the edge of each 3 m wide zone. Only those trials in which the participant passed the ball from within the target area was counted in the data. All other trials were noted and repeated.
If statistically significant group differences had been found, random samples of the video (nine trials per participant, 11.11%) would have been viewed by three collegiate volleyball coaches, blind to the purpose of the study, to rate the consistency of the tosses, and the tempo of passes noted by the experimenter to be unusual. Nine random video samples would have also been viewed by three psychology professors, blind to the purpose of the study, to rate the consistency of the interactions between theexperimenters and participants. Selection of the trials to be viewed would have been selected using the Research Randomizer (an online random number generator, www.randomizer.org). Any tosses or experimenter-participant interactions found to be inconsistent would have led to the removal of the associated participant data from analysis. This would have also necessitated the removal of the paired participant severely limiting the participant numbers.

Instrumentation

Data was collected on a standard 9 x 18 m volleyball court, with a net height of 2.24 m (official height for women’s competition). The dimensions of the raised passing target were 1.2 x 1.2 m with a 61 cm diameter whole in the center. It was situated with its right edge 3 m from and parallel to the right (when facing the net from the end line) sideline. The edge of the target closest to the net was 15 cm away, and 5 cm above (and parallel to) the net. The target was tilted 30 degrees from horizontal toward the end line on the passers’ side. The two target lines on the floor were semicircles with straight lines connecting the ends of the
semicircles to the center line, 1.5 and 3 m from the center of the target respectively. The experimenter tossed volleyballs from a point 6 m from the net and 1.5, 4.5, and 7.5 m from the sideline on the side of the court opposite the passers.

Data Analysis

Passing accuracy scores on the pre-test and post-test were averaged across all 18 trials. Practice scores (45) were averaged across 5 blocks of 9 trials each. The practice data were analyzed in a 2 (practice condition: self-control, yoked) x 5 (blocks) analysis of variance (ANOVA) with repeated measures on the last factor. To assess learning, accuracy scores on the pre- and post-tests were analyzed in a 2 (practice condition: self-control, yoked) x 2 (test: pre-test, post-test) ANOVA with repeated measures on the last factor. The IMI and PANAS-X data were analyzed in 2 (practice condition: self-control, yoked) x 3 (time: baseline, Day 1, Day 2) repeated-measures ANOVAs. For all analyses, $\alpha = .05$. 
CHAPTER 4

RESULTS

Analysis of Data

Passing Accuracy

To determine the effect of drill design choice (self-control versus yoked conditions) on forearm passing, passing accuracy scores were measured three times: pre-test and practice on Day 1, and post-test (retention) on Day 2. On the pre-test, self-control participants (mean: 4.49; SD: .31) and yoked participants (mean: 4.45; SD: .28) produced very similar scores (see Figure 2). During the five practice blocks, scores fluctuated somewhat but were similar for both groups. Also, there was no clear improvement across blocks. While post-test scores were higher compared with those on the pre-test, the self-control (mean: 4.61; SD: .34) and yoked (mean: 4.60; SD: .17) groups had very similar scores.

For the practice phase, the main effect of group was not significant, $F(1, 14) < 1$. Also, the main effect of block, $F(4, 56) = 1.01, p > .05$, and the interaction of group and block, $F(4, 56) < 1$, were not significant. The increase in scores from the pre-test to the post-test was significant, $F(1, 14) = 4.79, p < .05$, whereas the group main effect and the interaction of group and block, $Fs(1, 14) < 1$, were not significant.
Figure 2. Passing accuracy scores of the self-control and yoked groups on the pre-test, during practice, and on the post-test.

Affect

The Positive and Negative Affect Scale – Expanded Form (PANAS-X) was administered to the participants on three occasions: baseline, Day 1, and Day 2. On the baseline measure for positive affect, self-control participants and yoked participants produced very similar scores (see Figure 3). Means for both groups were also similar on Days 1 and 2. The main effect of group was not significant, $F(1, 14) < 1$. Also, the main effect of time, $F(2, 28) = 1.94$, $p > .05$, and the interaction of group and time, $F(2, 28) < 1$, were not significant.

For measurements of negative affect, scores for both groups were again very similar for baseline, Day 1, and Day 2 (see Figure 4). The main effect of group was not significant, $F(1, 14) < 1$. The main effect of time, $F(2, 28) = 2.20$, $p > .05$, and the interaction of group and time, $F(2, 28) < 1$, were also not significant.
Motivation

The Intrinsic Motivation Inventory (IMI), given to the participants on three separate occasions (baseline, Day 1, and Day 2), included measures of interest, value, and choice in regard to the forearm passing drill. Interest means for both groups were quite similar for baseline, Day 1, and Day 2 (see Figure 5). Because the assumption of sphericity was not met, the degrees of freedom were adjusted using the Greenhouse-Geisser correction. The main effect of group was not significant, $F(1, 14) < 1$. The main effect of time, $F(1.44, 20.12) = 15.85, p < .001$, was significant, however the main effect was not significant for the interaction of group and time, $F(1.44, 20.12) = 1.22, p > .05$. Post-hoc tests with a Bonferroni correction indicated that baseline differed significantly from Day 2 ($p < .001$), and Day 1 differed from Day 2 ($p < .01$).
Figure 4. Negative affect scores (PANAS-X) of the self-control and yoked groups on the baseline, Day 1, and Day 2.

Figure 5. Interest scores (IMI) of the self-control and yoked groups for baseline, Day 1 and Day 2.

The value measure produced means that varied little for the self-control and yoked groups for baseline, Day 1, and Day 2 (see Figure 6). The main effect of group was not significant, $F(1, 14) < 1$. The main effect of time, $F(2, 28) = 6.31$, $p < .01$, was significant, while the interaction of group and time, $F(2, 28) < 1$, was
not significant. Post-hoc tests using a Bonferroni correction indicated that baseline differed significantly from Day 2 ($p < .05$).

![Figure 6. Value scores (IMI) of the self-control and yoked groups for baseline, Day 1, and Day 2.](image)

The IMI choice measure showed the self-control group’s means to also be very similar to those of the yoked group across baseline, Day 1, and Day 2 (Figure 7). The main effect of group was not significant, $F(1, 14) < 1$. The main effect of time, $F(2, 28) = 22.11$, $p < .001$, was significant, though the interaction of group and time, $F(2, 28) = 2.12$, $p > .05$, was not. Post-hoc tests with a Bonferroni correction indicated that baseline differed significantly from Day 1 ($p < .05$), and Day 2 ($p < .05$), and Day 1 differed from Day 2 ($p < .001$).
**Figure 7.** Choice scores (IMI) of the self-control and yoked groups for baseline, Day 1, and Day 2.

**Statistical Analysis of Hypotheses**

**Hypothesis 1:** The null hypothesis was accepted and the research hypothesis rejected. After manipulation, there was no difference in intrinsic motivation between the self-control and yoked groups.

**Hypothesis 2:** The null hypothesis was accepted and the research hypothesis rejected. There was no difference between groups in passing accuracy as measured by retention test scores.

**Hypothesis 3:** The null hypothesis was accepted and the research hypothesis rejected. Positive affect did not differ between the two groups following manipulation.
CHAPTER 5
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Discussion of Results

The purpose of the present study was to examine the effect of self-controlled practice (autonomy) on the participants’ learning of a forearm passing task, intrinsic motivation, and affect. Learning was measured by comparing pre-test and post-test passing accuracy scores, intrinsic motivation by the IMI, and affect by the PANAS-X. Analysis of the data revealed no differences between the self-control (experimental) group and the yoked (control) group. That is, providing the self-control group with the opportunity to design their own forearm passing drill did not lead to a significant difference in learning, motivation or affect relative to the yoked group.

Sample size was expected to be relatively low (30) from the outset of this investigation. Previous research utilizing the IMI and/or PANAS-X reviewed in chapter 2 averaged more than 100 participants (e.g., Gillet et al., 2009; 2010; Hodge et al., 2009) but significant findings have also been achieved with sample sizes as small as 20 (e.g., Stoate, 2010). Scheduling difficulties involving student-athletes’ schedules, the availability of facilities, the experimenter’s travel arrangements, and coaches’ practice schedules led to much lower numbers (16) than anticipated. The small number of participants may have had an adverse effect on the questionnaire data.
Passing free balls (the underhand toss used by the experimenter is a common way in which a volleyball coach sends a free ball to a passer) is not a difficult skill for experienced volleyball players. The experimenter used the more sensitive measurement, in part, for this very reason. The 7-point scale was effective in that sense. The majority of the participants achieved mean scores (see Figure 2) of between 4 and 5 (out of a possible 6 points). Thus, there was room for improvement. An important issue may have been the participants’ recognition that passes worth 5 or 6 points, and even some of those earning 4 points would normally be considered “perfect” passes in competition. There may have been, therefore, less perceived need to pass with an average closer to 6. This also may have caused the participants to find less value in taking part in the drill. Major motives for student-athletes’ participation in collegiate sports include skill improvement, and challenge (Gould, Feltz, & Weiss, 1985; Klint & Weiss, 1986).

The scoring system used to measure passing awarded only one point for balls passed over the net regardless of how close those passes were to the target. Although giving a low score for an overpass is appropriate in terms of volleyball matches, as a scientific measure for performance an accuracy task, it may have inappropriately reduced scores. In effect, a score of 1 for an overpass rewarded a more conservative approach to the task. Those who aggressively aimed for the center of the target were penalized for missing high by mere centimeters. It is possible that those participants who felt more free to pursue the highest scores were the same ones who recorded more 1s.
Passing scores improved significantly from pre-test to post-test most likely because the participants adjusted to the circumstances of the task. It can be argued that this adjustment is learning though maybe not learning in terms of forearm passing so much as becoming familiar with the measurement of the task. Student-athletes are used to being evaluated on both their technique and outcome (Carter & Bloom, 2009). This study did not take technique into account, and outcome may have been less important in the participants’ minds for the reasons mentioned above. Without skill evaluation, the players may have found less value in the drill (and, therefore, less need for effort) as they were simply practicing repetitions of a simple skill. One would expect to see even more effective learning under circumstances where the participants are receiving feedback in regard to their technique.

It should also be considered that drill design choice may not provide enough autonomy to student-athletes to see a change in learning, performance, motivation, or affect. Possibly a significant change would come about by taking the idea of self-control a step further by providing participants the opportunity to choose a drill rather than the merely the components of it. Making this adjustment would cause the research design to become much more complicated but may yield beneficial effects of choice.

The IMI specifically measures perceived value and interest as indicators of intrinsic motivation (Ryan, 1982). If both the self-control and yoked groups perceived the drill to be of little value and interest to them, the intrinsic motivation scores would reflect that. Deci and Ryan (1985) propose a person will be
intrinsically motivated when they perform well under optimally challenging circumstances. This task does not appear to have been optimally challenging to the participants.

If the participants found little value and interest in the task, it is reasonable to assume they felt as if their time was not well-spent. Spending time on a task of low value and interest may likely lead to decreased positive affect and increased negative affect (King, Hicks, Krull, & Del Gaiso, 2006). Perhaps further explanation of the purpose of the study and the importance of the participants’ role in its outcome would have given them a more positive view of investment of time.

Due to individual participants’ and facility schedules, one of the two participating teams tested on a Friday evening after a team workout and again on the following Saturday morning. This very well could have led to a decrease in motivation and positive affect (and increased negative affect) which may have in turn led to weaker performance (Lyubomirsky, King, & Diener, 2005). The other team participated in the study during their regular practice times and tended to show generally higher (though not significantly) positive affect and motivation scores.

Participants may have misunderstood directions regarding the IMI. Based on the results of those in the self-control group who had significant choice in how to proceed in the passing drill during the practice phase, they seemed to be responding to the questions regarding choice in terms of choosing to participate
rather than choice within the drill itself. If that was indeed the case, the results would clearly be misleading.

Lastly, it may also be that autonomy provided during a time in which the participant has it in her mind that she would rather not be participating in the task is not powerful enough to overcome the lack of motivation and positive affect brought about by the negative mind set. Therefore one might not find an increase in learning, motivation, or affect. Perhaps questions regarding participants’ desire to take part in the study on each day of testing would help address this potential conflict.

Conclusions and Recommendations for Further Study

Referring to an experiment that had “failed,” Thomas Edison stated, “…we had learned for a certainty that the thing couldn’t be done that way, and that we would have to try some other way” (as cited in Runes, 1948, p. 43). This study did not lead to statistically significant group differences. That does not necessarily, however, indicate that drill design choice is an ineffective manner in which to increase the intrinsic motivation, passing accuracy and/or affect of student-athletes. It simply means the method used in this study is not the correct way to find the benefits of drill design choice.

As mentioned previously, sample size was a matter of concern for this study in general, and particularly because of the use of questionnaires for data collection. Future studies could utilize greater numbers of participants to more effectively examine the issues addressed here. Also, using participants who are
at a lower skill level will lead to greater numbers of qualified participants and the potential for greater learning.

In addition to increasing the sample size, a longitudinal study may be more effective. Student-athletes are not used to being given choice in how to practice a skill. They may not have felt qualified to make such a decision because they are used to relying on their coach(es) to direct them to what is “best.” If a team were to be given greater autonomy to make such decisions in practice and matches to the point they became accustomed to it, they may respond quite differently. Measuring passing accuracy, intrinsic motivation and affect before and after the implementation of such a long term autonomy-giving strategy may show different results.

It may also be interesting to discover what factors may have led self-control participants to choose the practice patterns used during the practice phase of the testing. Some participants seemed to be attempting to practice all of the possible combinations of serving and passing zones while others did not seem concerned at all with varying their practice. They may have based their patterns on preparation for the post-test, success during practice, or what they felt they needed or wanted to work on the most. A follow-up questionnaire or interview with participants could be used to determine this.

Discovering a significant increase in intrinsic motivation and/or positive affect with or without performance and learning increases would still be beneficial to coaches. Previous research has pointed to a relationship between such increases and better performance. If performance on the court did not improve,
certainly greater motivation and positive affect would benefit a team’s psychology.

In regard to measuring learning, it would be better measured, as is common, in lower-skilled performers along with the questionnaires used in this study. Finding corresponding changes in learning, motivation, and affect in beginners may lead to a better understanding of the relationships between those factors which may in turn lead to more effective research designs to be used with more advanced athletes.
Figure 8. Court and target dimensions
REFERENCES


Dental Research, New Orleans, LA. Retrieved from:


APPENDIX I

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now. Use the following scale to record your answers:

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>very slightly or not at all</td>
<td>a little</td>
<td>moderately</td>
<td>quite a bit</td>
<td>extremely</td>
</tr>
</tbody>
</table>

| ______ cheerful | ______ sad | ______ active | ______ angry at self |
| ______ disgusted | ______ calm | ______ guilty | ______ enthusiastic |
| ______ attentive | ______ afraid | ______ joyful | ______ downhearted |
| ______ bashful | ______ tired | ______ nervous | ______ sheepish |
| ______ sluggish | ______ amazed | ______ lonely | ______ distressed |
| ______ daring | ______ shaky | ______ sleepy | ______ blameworthy |
| ______ surprised | ______ happy | ______ excited | ______ determined |
| ______ strong | ______ timid | ______ hostile | ______ frightened |
| ______ scornful | ______ alone | ______ proud | ______ astonished |
| ______ relaxed | ______ alert | ______ jittery | ______ interested |
| ______ irritable | ______ upset | ______ lively | ______ loathing |
| ______ delighted | ______ angry | ______ ashamed | ______ confident |
| ______ inspired | ______ bold | ______ at ease | ______ energetic |
| ______ fearless | ______ blue | ______ scared | ______ concentrating |
| ______ disgusted | ______ shy | ______ drowsy | ______ dissatisfied |

with self
APPENDIX II

IMI

The following items concern your experience with the passing drill. Please answer all items. For each item, please indicate how true the statement is for you, using the following scale as a guide:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>not at all</td>
<td>true</td>
<td>somewhat</td>
<td>true</td>
<td>very</td>
<td>true</td>
<td></td>
</tr>
</tbody>
</table>

   1. I believe that doing this drill could be of some value for me.

   2. I believe I had some choice about doing this drill.

   3. While I was doing this drill, I was thinking about how much I enjoyed it.

   4. I believe that doing this drill is useful for improved concentration.

   5. This drill was fun to do.

   6. I think this drill is important for my improvement.

   7. I enjoyed doing this drill very much.

   8. I really did not have a choice about doing this drill.

   9. I did this drill because I wanted to.

   10. I think this is an important drill.

   11. I felt like I was enjoying the drill while I was doing it.
12. I thought this was a very boring drill.

13. It is possible that this drill could improve my game.

14. I felt like I had no choice but to do this drill.

15. I thought this was a very interesting drill.

16. I am willing to do this drill again because I think it is somewhat useful.

17. I would describe this drill as very enjoyable.

18. I felt like I had to do this drill.

19. I believe doing this drill could be somewhat beneficial for me.

20. I did this drill because I had to.

21. I believe doing this drill could help me do better in school.

22. While doing this drill I felt like I had a choice.

23. I would describe this drill as very fun.

24. I felt like it was not my own choice to do this drill.

25. I would be willing to do this drill again because it has some value for me.
### APPENDIX III

**Participant Means**

<table>
<thead>
<tr>
<th>Passing</th>
<th>Pre-test</th>
<th>Block 1</th>
<th>Block 2</th>
<th>Block 3</th>
<th>Block 4</th>
<th>Block 5</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-control</td>
<td>3.94</td>
<td>4.89</td>
<td>4.78</td>
<td>4.56</td>
<td>4.44</td>
<td>4.11</td>
<td>4.17</td>
</tr>
<tr>
<td>group</td>
<td>4.56</td>
<td>4.56</td>
<td>4.11</td>
<td>4.22</td>
<td>4.78</td>
<td>4.44</td>
<td>4.39</td>
</tr>
<tr>
<td></td>
<td>4.94</td>
<td>4.44</td>
<td>4.22</td>
<td>5.56</td>
<td>4.89</td>
<td>5.11</td>
<td>4.78</td>
</tr>
<tr>
<td></td>
<td>4.61</td>
<td>4.78</td>
<td>4.78</td>
<td>4.78</td>
<td>4.89</td>
<td>4.89</td>
<td>5.00</td>
</tr>
<tr>
<td></td>
<td>4.39</td>
<td>4.89</td>
<td>4.89</td>
<td>4.56</td>
<td>5.22</td>
<td>4.89</td>
<td>4.28</td>
</tr>
<tr>
<td></td>
<td>4.39</td>
<td>5.00</td>
<td>3.67</td>
<td>4.67</td>
<td>5.00</td>
<td>4.00</td>
<td>4.61</td>
</tr>
<tr>
<td></td>
<td>4.33</td>
<td>4.33</td>
<td>4.11</td>
<td>4.22</td>
<td>4.11</td>
<td>4.44</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>4.78</td>
<td>4.89</td>
<td>4.89</td>
<td>4.44</td>
<td>4.78</td>
<td>5.00</td>
<td>5.11</td>
</tr>
<tr>
<td>Yoked</td>
<td>4.50</td>
<td>4.11</td>
<td>4.44</td>
<td>4.78</td>
<td>4.11</td>
<td>4.22</td>
<td>4.28</td>
</tr>
<tr>
<td>group</td>
<td>4.39</td>
<td>4.56</td>
<td>4.56</td>
<td>4.11</td>
<td>4.56</td>
<td>4.89</td>
<td>4.72</td>
</tr>
<tr>
<td></td>
<td>4.72</td>
<td>5.11</td>
<td>5.11</td>
<td>4.78</td>
<td>4.44</td>
<td>4.67</td>
<td>4.78</td>
</tr>
<tr>
<td></td>
<td>4.00</td>
<td>4.67</td>
<td>3.89</td>
<td>4.56</td>
<td>5.11</td>
<td>4.33</td>
<td>4.50</td>
</tr>
<tr>
<td></td>
<td>4.61</td>
<td>4.44</td>
<td>4.89</td>
<td>5.22</td>
<td>4.67</td>
<td>5.00</td>
<td>4.78</td>
</tr>
<tr>
<td></td>
<td>4.78</td>
<td>4.89</td>
<td>4.33</td>
<td>5.11</td>
<td>5.33</td>
<td>4.56</td>
<td>4.56</td>
</tr>
<tr>
<td></td>
<td>4.11</td>
<td>4.33</td>
<td>4.22</td>
<td>4.56</td>
<td>4.33</td>
<td>5.11</td>
<td>4.56</td>
</tr>
<tr>
<td></td>
<td>4.50</td>
<td>4.22</td>
<td>4.89</td>
<td>4.33</td>
<td>5.00</td>
<td>4.44</td>
<td>4.61</td>
</tr>
<tr>
<td></td>
<td>Positive Affect</td>
<td>Negative Affect</td>
<td>Interest</td>
<td>Value</td>
<td>Choice</td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------</td>
<td>-----------------</td>
<td>-----------------</td>
<td>----------</td>
<td>-------</td>
<td>--------</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline</strong></td>
<td>3.10</td>
<td>1.40</td>
<td>5.50</td>
<td>6.89</td>
<td>4.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Self-control</strong> group</td>
<td>1.30</td>
<td>2.60</td>
<td>4.00</td>
<td>7.00</td>
<td>2.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.30</td>
<td>1.00</td>
<td>6.38</td>
<td>6.33</td>
<td>4.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.70</td>
<td>1.40</td>
<td>6.50</td>
<td>6.78</td>
<td>3.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.90</td>
<td>1.50</td>
<td>4.00</td>
<td>6.22</td>
<td>2.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.10</td>
<td>1.70</td>
<td>4.13</td>
<td>5.56</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.60</td>
<td>1.00</td>
<td>4.50</td>
<td>6.22</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.10</td>
<td>1.30</td>
<td>4.38</td>
<td>5.56</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Baseline</strong></td>
<td>4.60</td>
<td>1.30</td>
<td>6.25</td>
<td>7.00</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Yoked group</strong></td>
<td>3.20</td>
<td>1.20</td>
<td>5.63</td>
<td>7.00</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.40</td>
<td>1.00</td>
<td>6.38</td>
<td>6.44</td>
<td>5.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.50</td>
<td>1.30</td>
<td>6.50</td>
<td>6.22</td>
<td>5.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.10</td>
<td>1.00</td>
<td>4.50</td>
<td>5.44</td>
<td>3.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.40</td>
<td>1.30</td>
<td>2.88</td>
<td>7.00</td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.10</td>
<td>1.50</td>
<td>3.63</td>
<td>6.78</td>
<td>1.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.60</td>
<td>2.00</td>
<td>2.25</td>
<td>3.22</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 1</strong></td>
<td>4.60</td>
<td>1.10</td>
<td>5.50</td>
<td>6.00</td>
<td>5.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Self-control</strong> group</td>
<td>3.40</td>
<td>1.00</td>
<td>6.25</td>
<td>7.00</td>
<td>6.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.90</td>
<td>1.20</td>
<td>4.38</td>
<td>4.00</td>
<td>6.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.80</td>
<td>1.20</td>
<td>5.50</td>
<td>6.11</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.50</td>
<td>1.80</td>
<td>5.63</td>
<td>6.11</td>
<td>5.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.60</td>
<td>1.10</td>
<td>5.63</td>
<td>4.33</td>
<td>3.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4.10</td>
<td>1.00</td>
<td>5.25</td>
<td>5.44</td>
<td>5.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.50</td>
<td>1.10</td>
<td>5.25</td>
<td>5.11</td>
<td>5.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 1</strong></td>
<td>4.40</td>
<td>1.10</td>
<td>4.75</td>
<td>6.22</td>
<td>6.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Yoked group</strong></td>
<td>2.70</td>
<td>1.00</td>
<td>5.50</td>
<td>5.56</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.70</td>
<td>1.00</td>
<td>7.00</td>
<td>7.00</td>
<td>6.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.00</td>
<td>1.10</td>
<td>4.75</td>
<td>4.56</td>
<td>6.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.30</td>
<td>1.00</td>
<td>3.88</td>
<td>5.44</td>
<td>4.38</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.90</td>
<td>1.80</td>
<td>2.25</td>
<td>3.33</td>
<td>3.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20</td>
<td>2.10</td>
<td>2.88</td>
<td>5.44</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.80</td>
<td>1.20</td>
<td>4.25</td>
<td>6.67</td>
<td>3.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td>3.10</td>
<td>1.00</td>
<td>4.50</td>
<td>5.00</td>
<td>2.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Self-control</strong> group</td>
<td>1.60</td>
<td>1.60</td>
<td>2.50</td>
<td>5.89</td>
<td>1.75</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1.40</td>
<td>1.20</td>
<td>3.75</td>
<td>4.33</td>
<td>2.88</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.60</td>
<td>1.20</td>
<td>5.50</td>
<td>6.89</td>
<td>3.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20</td>
<td>1.30</td>
<td>3.13</td>
<td>4.56</td>
<td>2.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.90</td>
<td>1.50</td>
<td>3.13</td>
<td>3.67</td>
<td>1.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.80</td>
<td>1.00</td>
<td>3.50</td>
<td>5.56</td>
<td>1.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.90</td>
<td>1.10</td>
<td>3.63</td>
<td>4.89</td>
<td>2.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Day 2</strong></td>
<td>3.80</td>
<td>1.10</td>
<td>3.75</td>
<td>5.33</td>
<td>4.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Yoked group</strong></td>
<td>2.00</td>
<td>1.00</td>
<td>3.75</td>
<td>4.22</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.60</td>
<td>1.00</td>
<td>4.38</td>
<td>5.33</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5.00</td>
<td>1.00</td>
<td>6.25</td>
<td>7.00</td>
<td>2.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.30</td>
<td>1.30</td>
<td>2.88</td>
<td>4.78</td>
<td>3.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.70</td>
<td>1.40</td>
<td>1.75</td>
<td>2.56</td>
<td>3.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.20</td>
<td>1.40</td>
<td>2.00</td>
<td>4.78</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2.90</td>
<td>1.30</td>
<td>1.75</td>
<td>5.11</td>
<td>2.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX IV

IRB APPROVALS

UNLV

Biomedical IRB – Expedited Review
Modification Approved

NOTICE TO ALL RESEARCHERS:
Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation, suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.

DATE: February 15, 2011
TO: Dr. Gabriele Wulf, Kinesiology
FROM: Office of Research Integrity – Human Subjects
RE: Notification of IRB Action by Cindy Lee-Tatasee/ Ms. Cindy Lee-Tatasee, BS, CIP, CIM
Protocol Title: Forearm Passing in Expert Volleyball Players
Protocol #: 1010-3627M
Expiration Date: November 4, 2011

The modification of the protocol named above has been reviewed and approved.

Modifications reviewed for this action include:
- Addition of members of intercollegiate women's volleyball program at Wichita State University as subjects.
- Revision of Informed Consent to include new population.
- Addition of Wichita State University's practice court at Charles Koch Arena as a project site.
- Addition of GPSA funding and funding form the Kinesiology Department for travel expenses to Wichita, KS.

This IRB action will not reset your expiration date for this protocol. The current expiration date for this protocol is November 4, 2011.

PLEASE NOTE:
Upon approval, the research team is responsible for conducting the research as stated in the protocol most recently reviewed and approved by the IRB, which shall include using the most recently submitted Informed Consent/Assent forms and recruitment materials. The official versions of these forms are indicated by footer which contains approval and expiration dates.

Should there be any change to the protocol, it will be necessary to submit a Modification Form through ORI - Human Subjects. No changes may be made to the existing protocol until modifications have been approved by the IRB. Modified versions of protocol materials must be used upon review and approval. Unanticipated problems, deviations to protocols, and adverse events must be reported to the ORI – HS within 10 days of occurrence.

Should the use of human subjects described in this protocol continue beyond November 4, 2011, it would be necessary to submit a Continuing Review Request Form 30 days before the expiration date.

If you have questions or require any assistance, please contact the Office of Research Integrity – Human Subjects at IRB@unlv.edu or call 895-2794.

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047
(702) 895-2794 • FAX: (702) 895-0815
TITLE OF STUDY: Forearm Passing in Expert Volleyball Players

INVESTIGATORS: Gabriele Wulf, Ph.D., Nels Rydberg, and Brad McKay

CONTACT PHONE NUMBER: 702-895-0938 (Wulf), 702-241-1660 (Rydberg), or (702) 788-5890 (McKay)

Purpose of the Study
You are invited to participate in a research study. The purpose of this study is to evaluate a pass rating scale, and a forearm passing drill when performed by expert female volleyball players.

Participants
You are being asked to participate in the study because you are a member (or recent member) of the UNLV or Wichita State University Women’s Volleyball team and are therefore considered to be a volleyball expert.

Procedures
If you volunteer to participate in this study, you will be asked to come into the gym for approximately 30 minutes on two days. Each day you will perform an individual forearm passing drill and fill out two questionnaires.

Benefits of Participation
There may not be direct benefits to you as a participant in this study. However, we hope to learn more about forearm passing drill design and rating scales through the data gathered.

Risks of Participation
There are some risks involved in all research studies. You may experience some minor discomfort caused by delayed onset muscle soreness following participation in the drills.

Cost / Compensation
There will be no financial cost to you to participate in this study. The study will take 30 minutes of your time on two separate occasions. You will not be compensated for your time.
FOREARM PASSING IN EXPERT VOLLEYBALL PLAYERS

Contact Information
If you have any questions or concerns about the study, you may contact Dr. Gabriele Wulf at 702-895-0938 (or gabriele.wulf@unlv.edu), Nels Rydberg at 702-241-1860 (or nels.rydberg@gmail.com), or Brad McKay at 701-234-3731 (or bradmckay8@gmail.com). For questions regarding the rights of research subjects, any complaints, or comments regarding the manner in which the study is being conducted you may contact the UNLV Office of Research Integrity – Human Subjects at 702-895-2794.

Voluntary Participation
Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality
All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for 3 years after completion of the study. After the storage time, the information gathered will be destroyed.

Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

_________________________________________  ____________________________
Signature of Participant                     Date

_________________________________________
Participant Name (Please Print)

_________________________________________
Participant Initials

Approved by the UNLV IRB. Protocol 1010-3627M
Received: 01-28-11 Approved: 02-15-11 Expiration: 11-04-11
Biomedical IRB – Expedited Review
Approval Notice

NOTICE TO ALL RESEARCHERS:
Please be aware that a protocol violation (e.g., failure to submit a modification for any change) of an IRB approved protocol may result in mandatory remedial education, additional audits, re-consenting subjects, researcher probation, suspension of any research protocol at issue, suspension of additional existing research protocols, invalidation of all research conducted under the research protocol at issue, and further appropriate consequences as determined by the IRB and the Institutional Officer.

DATE: November 5, 2010
TO: Dr. Gabriele Wulf, Kinesiology
FROM: Office of Research Integrity - Human Subjects
RE: Notification of IRB Action by Dr. Charles Rasmussen, Co-Chair
Protocol Title: Forearm Passing in Expert Volleyball Players
Protocol #: 1010-3627M

This memorandum is notification that the project referenced above has been reviewed by the UNLV Biomedical Institutional Review Board (IRB) as indicated in regulatory statutes 45 CFR 46. The protocol has been reviewed and approved.

The protocol is approved for a period of one year from the date of IRB approval. The expiration date of this protocol is November 4, 2011. Work on the project may begin as soon as you receive written notification from the Office of Research Integrity - Human Subjects (ORI - Human Subjects).

PLEASE NOTE:
Attached to this approval notice is the official Informed Consent/Assent (IC/A) Form for this study. The IC/A contains an official approval stamp. Only copies of this official IC/A form may be used when obtaining consent. Please keep the original for your records.

Should there be any change to the protocol, it will be necessary to submit a Modification Form through ORI – Human Subjects. No changes may be made to the existing protocol until modifications have been approved by the IRB.

Should the use of human subjects described in this protocol continue beyond November 4, 2011 it would be necessary to submit a Continuing Review Request Form 60 days before the expiration date.

If you have questions or require any assistance, please contact the Office of Research Integrity – Human Subjects at IRB@unlv.edu or call 895-2794.

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047
INFORMED CONSENT

Department of Kinesiology and Nutrition Sciences

TITLE OF STUDY: Forearm Passing in Expert Volleyball Players

INVESTIGATORS: Gabriele Wulf, Ph.D., Nels Rydberg, and Brad McKay

CONTACT PHONE NUMBER: 702-895-0938 (Wulf), 702-241-1660 (Rydberg), or (702) 788-5890 (McKay)

Purpose of the Study
You are invited to participate in a research study. The purpose of this study is to evaluate a pass rating scale, and a forearm passing drill when performed by expert female volleyball players.

Participants
You are being asked to participate in the study because you are a member (or recent member) of the UNLV Women’s Volleyball team and are therefore considered to be a volleyball expert.

Procedures
If you volunteer to participate in this study, you will be asked to come into the gym for approximately 30 minutes on two days. Each day you will perform an individual forearm passing drill and fill out two questionnaires.

Benefits of Participation
There may not be direct benefits to you as a participant in this study. However, we hope to learn more about forearm passing drill design and rating scales through the data gathered.

Risks of Participation
There are some risks involved in all research studies. You may experience some minor discomfort caused by delayed onset muscle soreness following participation in the drills.

Cost /Compensation
There will be no financial cost to you to participate in this study. The study will take 30 minutes of your time on two separate occasions. You will not be compensated for your time.

Participant Initials
FOREARM PASSING IN EXPERT VOLLEYBALL PLAYERS

Contact Information
If you have any questions or concerns about the study, you may contact Dr. Gabriele Wulf at 702-895-0938 (or gabriele.wulf@unlv.edu), Nels Rydberg at 702-241-1660 (or nels.rydberg@gmail.com) or Brad McKay at 701-234-3731 (or bradmckay8@gmail.com). For questions regarding the rights of research subjects, any complaints, or comments regarding the manner in which the study is being conducted you may contact the UNLV Office of Research Integrity – Human Subjects at 702-895-2794.

Voluntary Participation
Your participation in this study is voluntary. You may refuse to participate in this study or in any part of this study. You may withdraw at any time without prejudice to your relations with the university. You are encouraged to ask questions about this study at the beginning or any time during the research study.

Confidentiality
All information gathered in this study will be kept completely confidential. No reference will be made in written or oral materials that could link you to this study. All records will be stored in a locked facility at UNLV for 3 years after completion of the study. After the storage time, the information gathered will be destroyed.

Participant Consent:
I have read the above information and agree to participate in this study. I am at least 18 years of age. A copy of this form has been given to me.

Signature of Participant ___________________________ Date ____________

Participant Name (Please Print) ____________________

Participant Initials _____

2 of 2
Date: 7 February 2011

Principal Investigator: Korey Torgerson; Gabriele Wulf

Co-Principal Investigator: Nels Rydberg

Department: Department of Kinesiology/P.A

Campus Mail Box: 018

IRB No.: 2261

The University Institutional Review Board (IRB) has reviewed your research project application entitled:

"Forearm Passing in Expert Volleyball Players"

and approved the project according to the Federal Policy for the Protection of Human Subjects. As described, the project also complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please keep in mind the following:

1. Any significant change in the experimental procedure as described should be reviewed by the IRB prior to altering the project.
2. When signed consent documents are required, the principal investigator must retain the signed consent documents for at least three years past completion of the research activity.
3. At the completion of the project, the principal investigator is expected to submit a Final Report; the form is attached.

Thank you for your cooperation. If you have any questions, please contact me at ext. 5742.

Sincerely,

Terry Belmendi, Ed.D.
Chairperson, IRB
Final Report

For

Research Involving Human Subjects

I certify that the study entitled:

"Forearm Passing in Expert Volleyball Players"

was conducted as described in the approved protocol; and

1. That I will retain records of informed consent of my subjects for at least three (3) years after the subjects' participation.

Signature of Investigator  
2/24/11  
Date

(green)  
ORA March 2009
VITA

Graduate College
University of Nevada, Las Vegas

Nels Rydberg

Degrees:
  Bachelor of Science, Physical Education, 1993
  California Polytechnic State University

Thesis Title: The Effect of Self-Controlled Practice on Forearm Passing, Motivation, and Affect in Women’s Volleyball Players

Thesis Examination Committee:
  Chairperson, Dr. Gabriele Wulf, Ph. D.
  Committee Member, Dr. John Mercer, Ph. D.
  Committee Member, Dr. Janet Dufek, Ph. D.
  Graduate Faculty Representative, Dr. Erin Hannon, Ph. D.