

A comparison of performance in materials-based, imagery-based, and rote exercise in adult males

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Graduate School

FINAL APPROVAL OF SCHOLARLY PROJECT
For the Degree of
Master of Occupational Therapy

Title of Scholarly Project A Comparison of Performance in Materials-based,
Imagery-based, and Rote Exercise in Adult Males

Submitted by

Erin Raitz

(Name)

In partial fulfillment of the requirements for the degree
Master of Occupational Therapy

APPROVED

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Attachment: Abstract

Final Approval of SP MOT

A Comparison of Performance in
Materials-Based, Imagery-based, and Rote Exercise
in Adult Males

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Abstract

Objective. By using added purpose and motivation (e.g., materials-based exercise and imagery-based exercise), occupational therapists hope to increase the willingness of patients to perform occupations. The purpose of this study was to attempt to determine if there was a difference between materials-based, imagery-based, and rote exercise in the performance of healthy adult males.

Methods. In a counterbalance design, 30 healthy adult males between ages 19-51 years, experienced three conditions of exercise. The dependent variables analyzed were the number of repetitions performed, the duration of the exercise performed, and the number of rest breaks greater than five seconds.

Results. Using a multivariate analysis of variance (MANOVA), significant differences were found in the number of repetitions performed in each condition ($p < .03$) and the duration of exercise performed in each condition ($p < .02$). There were no significant differences found for the number of rest breaks taken between the three conditions. There were order effects found with participants who performed in the imagery-based condition first ($p < .01$).

Conclusion. The hypotheses were supported by results indicating a greater number of repetitions for a longer duration when added purpose (e.g., materials-based exercise and imagery-based exercise) was included in the condition. Further research should be conducted to continue to provide support that when incorporating added purpose and meaning there is a motivating factor to enhance performance.

A Comparison of Performance in Materials-Based, Imagery-based, and Rote Exercise in Adult Males

The profession of occupational therapy was started with the idea that patients would be using purposeful occupation as the means of therapy. This idea was theorized from the premise that people would gain increased functional levels of living from the benefits of purposeful therapy (e.g., Baldwin, 1919; Dunton, 1931). Today, occupational therapists strive to collaborate with the patient to reach his or her goals, enhance performance, and promote an independent way of living. By using motivation and purpose, occupational therapists hope to increase the willingness of patients to perform the occupations necessary for them to live as an individual. Therapists have tried imagery-based and materials-based occupations to gain added purpose and motivation. The present study attempted to determine the difference between rote exercise, imagery-based exercise and materials-based exercise in the performance of college age males during a throwing occupation. Research regarding occupationally embedded exercise including materials-based, imagery-based, and rote exercise will be discussed. Following the literature review, the present study will be introduced.

Therapeutic Occupation

In 1919, Bird T. Baldwin said the principle of occupational therapy was, “specific voluntary movements involved in the ordinary trades and occupations, physical training, play or the daily routine activities of life” (p. 5). Dunton also believed that it was, “desirable to engage his interests in the work he is doing” (1931, p. 113). Early founders advocated that therapy should require the use of occupations that the patient has some purpose in performing. Today, therapists are still focusing on using purposeful occupations that are meaningful to the patients.

According to Thomas, “occupational therapy’s unique contribution to patient treatment is its use of therapeutic occupations (purposeful activities) to remediate and promote function” (performance of occupations to the satisfaction of self and others) (1996, p.783). Occupational therapists use occupational forms (set of circumstances external to the person that elicits, guides, or structures the person) to lead to an occupational performance (the voluntary doing of the person) that will evoke positive increases in the patient’s current level of function (Nelson, 1994). Occupational therapists collaborate with patients to find an appropriate challenge that will bring them to a more independent level of function.

By using purposeful occupations, theorists have been trying to prove that it increases the patient’s desire to work. Researchers have shown that purposeful occupation leads to greater increases in strength and endurance (Yoder, Nelson, & Smith, 1989; Riccio, Nelson, & Bush, 1990; Lang, Nelson, & Bush, 1992; DeKuiper, Nelson, & White, 1993; Hsieh, Nelson, Smith, & Peterson, 1996). They also have shown that purposeful occupation leads to an increase in energy exertion (Kircher, 1984; Thomas, 1996), and smoother, more controlled movements in individuals (Wu, Trombly, & Lin, 1994; Hall & Nelson, 1998; Ross & Nelson, 2000; Fasoli, Trombly, Tickle-Degnen, & Verfaellie, 2002). Each of these variables are aspects therapists strive to gain for patients.

Purposeful occupation is the backbone of what has now become the profession of occupational therapy. Past theorists have advocated that it is through added purpose and increased motivation that the greatest capacity for function and overall well being can be attained (e.g., DeKuiper et al., 1993; Nelson & Peterson, 1989; American Occupational Therapy Association, 1979). Incorporating purpose and motivation to therapeutic interventions are what make the profession of occupational therapy unique to other health care professions. Therapists

collaborate with patients to ensure the aspect of added purpose that theorists believe to be the key to high levels of functioning while decreased motivation is a contributing factor to low levels of functioning (DeKuiper et al., 1993). DeKuiper et al. stated that, “by synthesizing various components of the occupational form and creating what is intended to be a purposeful activity (occupation), motivation may be increased and occupational performance, the active response, enhanced” (p.184).

Therapists have three ways of trying to gain purpose in the occupations they choose in therapy: rote exercises, materials-based exercises, and imagery-based exercises. Rote exercise adds the least amount of added purpose to exercises. Nelson and Peterson define it as “... any repetitive pattern of movement in which the exerciser’s focus is on the movement per se” (1989, p. 16). Occupation is not being used for therapeutic gains when rote exercise is used as a treatment.

Two additional types of exercise are materials-based and imagery-based. Materials-based is the use of external objects to add to the purpose of the occupation. An example of materials-based exercise is using a jump rope to perform a jumping motion or hammering a nail into a board. The use of imagery-based exercise is the absence of the material, but the patient uses his or her imagination while performing the movement. An example of imagery-based exercise is reaching down while imaging to gather coins off the ground or biceps curls mimicking the same motion as hammering a nail. As Riccio et al. (1990) points out, “the distinction between imagery-based occupation and simulated (materials-based) occupation is that verbal or pictorial cues referring to absent materials are used to elicit imagery-based occupation, whereas props are used in simulated occupation (p.715).”

Review of Materials-based, Imagery-based, and Rote Exercise Literature

In reviewing the literature on the effects of imagery, materials-based, and rote exercise many findings have demonstrated an added benefit to materials-based and imagery-based exercise over rote. This is not to say rote exercise does not serve its own purpose in therapy. For example, a person may have an interest in a straight rote type of exercise in which case it would be occupational and purposeful to that person (Trombly, 1982; Nelson & Peterson, 1989). A person's goal may be to increase muscle mass which would make rote exercise purposeful.

One of the first studies conducted on occupationally embedded exercise (i.e. materials-based exercise) versus rote exercise was by Kircher (1984). Kircher researched the effects of purposeful versus nonpurposeful occupation. She studied the effect of jumping with a rope versus jumping without a rope on heart rate and total exercise time in twenty-six healthy adult females between the ages of 19-37 years old. She concluded that the participants had a higher increase in heart rate when jumping with a rope compared to when they jumped without the rope. Kircher argued that her results indicated increased motivation by the increased duration of jumping and increased heart rate. In other words, the participant had a higher heart rate because she was motivated to jump rope for a longer duration of time. This study began a line of research that provided evidence that adding purpose to therapeutic occupation could be motivating to the person.

Yoder, Nelson, and Smith (1989) investigated the use of materials-based exercise versus rote exercise during a cookie dough stirring exercise in thirty female nursing home residents between the ages of 70-92 years old. Yoder et al. (1989) researched the number of rotations each participant used to stir the dough and how long she performed the occupation. Similar to Kircher, they hypothesized that participants performing added purpose occupations would take

part in more exercise repetitions, which was the number of rotations for stirring, and stir for a longer period of time with fewer breaks. The participants in this study were placed in one of two groups: materials-based exercise and rote exercise. The materials-based group had the added visual stimulus of a plate of baked cookies and the cooking utensils. This group also had an olfactory stimulus of vanilla that was mixed into the batter of cookie dough. The rote exercise group simply was told to exercise by stirring cookie dough without the added sight of the cookies, cooking utensils, or smell of vanilla. Yoder et al. reported that the materials-based group stirred cookie dough for a longer period of time and performed more repetitions with fewer breaks compared to the rote exercise group. This study provides additional support to the theory of added purpose in occupationally embedded exercise for occupational therapy.

Hsieh, Nelson, Smith, and Peterson (1996) compared occupationally embedded exercises to rote exercises in older adult males and females between 51-78 years old that were diagnosed with unilateral cerebral hemiplegia. Hsieh et al. (1996) studied materials-based exercise, imagery-based exercise, and rote exercises in a counterbalance design comparing the number of exercise repetitions from each condition. The materials-based occupation was bending over, picking up a ball with the unimpaired hand and throwing it at a target. For the imagery-based exercise participants imagined using the unimpaired hand when bending over to pick up a ball and throwing it, and for the rote exercise participants simply touching the ground, standing back up, elevating the arm with elbow flexion, and a quick arm stretch forward. One repetition was considered to be a complete cycle of bending to the ground, reaching the hand to the floor, standing back up, and moving the arm in a throwing motion. The researchers reported a significant difference in the number of repetitions with the materials-based exercise being performed more than the rote exercise as well as the imagery-based exercise being performed

more than the rote exercise. They did not find a significant difference between the materials-based exercise and the imagery-based exercise. Hsieh et al. provided more support to the principle that added purpose has a positive effect to promote performance.

A similar study by Lang, Nelson, and Bush (1992) compared materials-based exercise, imagery exercise and rote exercise on the number of kicking exercises performed. Lang et al. (1992) studied 15 participants aged 56-93 years old from two nursing homes. The participants kicked a balloon as the materials-based exercise, and the imagery-based exercise had instructions for participants to imagine a balloon coming towards their foot to kick as they go through the kicking motion with their leg. When the participants were performing the rote exercise, it involved instructions and a demonstration to kick their foot. Lang et al. reported significant differences between the materials-based condition and the imagery and rote conditions but no difference between the imagery and the rote condition in terms of number of repetitions. The materials-based occupation had the greatest number of repetitions. This study has implications supporting that the use of materials produces a greater number of repetitions during exercise.

A study by Wu, Trombly, and Lin (1994) continued this line of research comparing the kinematics of materials-based exercise, imagery-based exercise, and rote exercise with 37 right-handed, female adults aged 17 to 32 years old. The dependent variables included reaction time, movement time (time for execution of the movement), movement units (one acceleration and one deceleration of movement), total displacement (the path of movement taken), peak velocity, and the percentage of reach where peak velocity occurred. Each participant engaged in the occupations of picking up a pencil and writing her name (materials-based exercise), imagining picking up a pencil and pretending to write her name (imagery-based exercise), and reaching forward the same distance as in the other two variables (rote exercise). The researchers reported

an enhanced motor performance in respect to a better quality of movement as shown by better movement time, movement units, and total displacement with the use of materials compared to both imagery-based and rote exercise. In addition, Wu et al. (1994) reported that the imagery and rote exercise shared similar results indicating no significant difference between the two conditions on the dependent variables. The implications of this study show that the participant's movement was more efficient, more precise, and of higher quality when performing exercise with materials when compared to imagery-based exercise and rote exercise.

Riccio, Nelson, and Bush (1990) compared imagery-based exercise and rote exercise on the frequency of repetitions and the duration of a reaching up and down exercise. Twenty-seven elderly females between the ages of 62-96 years old served as participants. The imagery-based condition was to reach up and imagine picking apples and to reach down and imagine picking up coins. Verbal instructions with a demonstration were included. The rote exercise condition included verbal instructions and a demonstration of alternating her arms reaching up and reaching down. The researchers reported a statistically significant difference between the imagery-based exercise compared to the rote exercise in the reaching up component but no significant difference between the imagery-based exercise and rote exercise in the reaching down component. Individuals in the imagery-based condition completed more exercise repetitions. Two possible explanations for this result are that the reaching down exercise may not have been meaningful or it may not have been as familiar as reaching up for apples. This implies that upper extremity movement with meaning and familiarity are important factors to consider when developing treatment plans for upper extremity disorders.

The Present Study

Added purpose and motivation to exercise has been compared to nonpurposeful exercise in many different forms. Researchers have studied the comparison of materials-based, imagery-based, and rote exercises in terms of the number of exercise repetitions, the total duration spent performing the occupation, the effects on heart rate, the number of rest breaks taken, and the effects on kinematic variables. Main populations studied included females.

This present study is a variation of the Hsieh et al. (1996) study. Healthy, young adult males were studied due to a limited amount of research conducted with this population. The following hypotheses were predicted. In healthy, young adult males the use of the materials-based exercise will result in a greater number of repetitions performed compared to the rote exercise and imagery-based exercise. It was also predicted that in healthy, young adult males the imagery-based exercise will result in a greater number of repetitions performed compared to the rote exercise. Materials-based exercise will also have less periods of rest than imagery-based exercise and rote exercise for healthy, young adult males. Finally, in young adult males, imagery-based exercise will show less periods of rest than rote exercise. These hypotheses were based on previous studies, which had results showing a greater number of repetitions with materials-based exercise and also with imagery-based exercise when compared to rote exercise (Riccio et al., 1990; DeKuiper et al., 1993; Lang et al., 1992; and Hsieh et al., 1996).

Method

Participants

Thirty healthy males, ages 19-51 years, with no recent medical history of any orthopedic injuries or central nervous system disease, served as participants in this study. The mean age was 26.27 years ($SD = 6.39$ years). Of the thirty participants, twenty-seven had right hand

dominance and three had left hand dominance. Participants were recruited by flyer advertisements and word of mouth.

Materials

The materials-based exercise condition included throwing small balls at a target. The balls were standard size and color of tennis balls. The target was a poster board (135 cm x 100 cm) with a cutout face (eyes, nose, and mouth) attached.

Procedure

After obtaining informed consent, each participant completed three conditions (i.e., materials-based exercise condition, imagery-based exercise condition, and rote exercise condition) at the same time of day in the same environment. The participants were randomly assigned to the groups in a counterbalance design. Group A had the participants performing the materials-based exercise condition first, the imagery-based exercise condition second, and the rote exercise condition third. In Group B, participants had the imagery-based exercise condition first, the rote exercise condition second, and the materials-based exercise condition last. In Group C, participants performed the rote exercise condition first, the materials-based exercise condition second, and the imagery-based exercise condition third.

In the materials-based exercise condition, participants bent down, used their dominant hand to pick up the small ball, stood back up, and threw it at the target. The imagery-based exercise condition required the participants to imagine bending over to pick up a ball with their dominant hand and then throwing it at an imagined target. In the rote exercise condition, participants touched the ground with their dominant hand, stood back up, and elevated the arm while flexing the elbow and stretching the arm quickly.

The materials-based exercise condition had a target placed 15 feet in front of the participant. A research assistant stood behind the participant and placed the balls on the ground near him on his dominant side. Standard instructions were given to the participant for each condition. In the materials-based exercise condition the participants were given the following instructions:

Reach down and pick up a tennis ball. Stand back up and throw it at the target. Strength and speed do not matter. You watch first while I demonstrate. Now you try a few. When I tell you to begin, pick up a ball and throw it towards the target as many times as you can without becoming too tired. Stop when you are too tired. Ready? Begin.

The instructions for the imagery-based exercise condition to the participants were given as follows:

Reach down to the ground using your dominant hand as if you were picking up a small ball you had dropped. Stand back up and pretend as if you were throwing the ball towards a target. Watch me. Now you try a few. When I tell you to begin, pick up the ball and stand up as if you were going to throw a ball as many times as you can without becoming too tired. Stop when you are too tired. Ready? Begin.

In the rote exercise condition, the participants were given the following instructions:

We are going to exercise our arms and legs. Listen to all of the directions first then I will demonstrate the exercise and give you a chance to try. Reach all the way down to the ground bending at the knees and touch the floor. Stand back up while bringing your arm forward and flexing your elbow until it is

behind your head. As quick as you can, swing your arm back to the front over your head. Watch me. Now you try a few. When I tell you to begin, do as many as you can without becoming too tired. Stop when you are too tired. Ready? Begin.

Upon completion of each exercise, the participant was given an opportunity to rest if necessary. When the participant was ready to begin again, he performed the next exercise condition.

Following the instructions, the researcher sat about six feet away facing the participant. During the materials-based exercise condition, the research assistant was next to the participant collecting the balls as they came back toward the participant. For the imagery-based exercise condition and rote exercise condition, the research assistant was seated six feet away from the participant. If a participant asked when he could stop or how many exercises he should do, the researcher replied, "Try your best; stop when you are too tired." If a participant ceased repeating the performance or took a rest for 5 seconds (a discontinuity), the researcher asked him to do more exercise and added, "You can stop when you are too tired."

Measurement

The frequency and duration of exercise repetitions and the frequency of discontinuities that lasted at least 5 seconds were measured with a stopwatch and two counters. The stopwatch and counters were kept out of the participant's sight and were silent. A repetition was a completed cycle of bending down, reaching the hand within 5 cm of the floor, standing up, raising the arm, flexing the elbow, and extending the arm forward quickly.

Data Analysis

Order effects were measured for the three sessions of each condition through a multivariate analysis of variance (MANOVA). To find differences among the three conditions, a MANOVA for a within participant design was used. The results were considered to be significant at the .05 level of confidence.

Results

The repetitions performed for the materials-based exercise condition ranged from 15 to 512 repetitions ($M = 103.83$, $SD = 119.44$). The repetitions performed for the imagery-based exercise condition ranged from 13 to 567 ($M = 90.40$, $SD = 128.45$). The repetitions performed for the rote exercise condition ranged from 12 to 153 ($M = 55.50$, $SD = 37.69$). The length of time each participant spent performing the materials-based exercise condition ranged from 32 seconds to 1159 seconds ($M = 244.60$, $SD = 273.22$). The length of time each participant spent performing the imagery-based exercise condition ranged from 21 seconds to 1400 seconds ($M = 210.93$, $SD = 334.06$). The length of time each participant spent performing the rote exercise condition ranged from 25 seconds to 345 seconds ($M = 119.57$, $SD = 83.98$). The number of rest breaks lasting longer than 5 seconds for the materials-based exercise condition ranged from 0 to 3 breaks ($M = .27$, $SD = .64$). The number of rest breaks lasting longer than 5 seconds for the imagery-based exercise condition ranged from 0 to 1 break ($M = .13$, $SD = .35$). The number of rest breaks lasting longer than 5 seconds for the rote exercise condition ranged from 0 to 1 breaks ($M = .03$, $SD = .18$) (see Table 1 for a summary of the results).

Mauchly's Test of Sphericity revealed that the assumption for sphericity was significant ($p < .05$) for each of the analyses (e.g., repetition, duration, and rest breaks). Therefore, the corrected Greenhouse-Geisser estimate is reported. Using a MANOVA, significant differences

were found in the number of repetitions performed in each condition ($F = 3.74$, $df = 1.38$, $p < .05$) and the duration of exercise performed in each condition ($F = 4.14$, $df = 1.36$, $p < .04$). Although Tukey's post-hoc analyses did not reveal any statistically significant differences between the three conditions, when considering the mean values, the materials-based condition performed the most repetitions with the longest duration, followed by the imagery-based condition, and the rote exercise group having the least number of repetitions and shortest duration. The MANOVA for breaks revealed that there were no significant differences found for the number of rest breaks taken between the three conditions ($F = 2.013$, $df = 1.425$, $p < .16$). There were order effects found in repetition and duration with participants who performed in the imagery-based condition first ($F = 7.86$, $df = 2$, $p < .001$; $F = 7.93$, $df = 2$, $p < .001$, respectively). The order effects showed a greater number of repetitions and duration when the males participated in the imagery-based condition first.

Discussion

The results of this study indicate that when adding meaning and purpose to an exercise, it can elicit greater performance in terms of higher repetitions and longer duration. For this study, the materials-based and imagery-based exercise conditions were the measures for increasing motivation to perform more repetitions for a longer duration when compared to rote exercise. These results support those of previous studies which used materials and imagery for added purpose in order to perform a greater number of repetitions (Yoder et al., 1989; Riccio et al., 1990; Lang et al., 1992; DeKuiper et al., 1993; Hsieh et al., 1996; and Thomas, 1996). The outcome of this study is analogous to that of these studies and supports the idea that adding meaning and purpose can motivate the client for greater performance. Our study has shown by these results that the materials-based occupation is also a motivator for performance with the

healthy male population as it has shown to be for the healthy female population (Kircher, 1984; Wu et al., 1994; Hall & Nelson, 1998; and Ross & Nelson, 2000).

This study is supportive to the fact that the use of meaning and purpose can increase motivation for promoting performance. Nelson and Peterson (1989) stated the following as advantages to using added purpose with occupation: “Purposeful activities tend to provide additional information that elicits and supports movement; Isolated, repetitive exercise, even if performed diligently, may lead nowhere because of its disconnectedness from everyday life; activities provide relatively frequent types of feedback and rewards; and activity provides a way to speed up gratification without resorting to extrinsic motivators” (pp. 16-17). This study was performed on the basis that we would find results indicating that when added purpose was incorporated into exercise, it would be a motivator to enhance performance. Similar results from past literature also indicate that when added purpose was used with exercise it was a motivator to enhance performance (Kircher, 1984; Yoder et al., 1989; Hsieh et al., 1996; & Riccio et al., 1990). These implications relate back to the theory that occupational therapy is based on. The use of purposeful therapy can increase functional levels of living for a person (e.g., Baldwin, 1919; Dunton, 1931). Our study was designed to assist in providing positive evidence to this theory specific to the healthy adult male population. Results of this study may be used to support the importance of using materials-based occupations as a means of occupationally embedded exercise for healthy males.

Implications

This study indicates that with a materials-based exercise, it can be expected that more repetitions may be performed for longer periods of time in the male population. It can also indicate that when using imagery-based exercise as opposed to rote exercise, more repetitions

can be expected to be performed for longer durations in the male population. These are important implications for occupational therapy practitioners because it provides evidence that when there is a purpose in what the client is being asked to do during a therapy session, he may be more motivated to complete the exercise. If the client is more willing to perform the exercise and put a greater effort into something that has meaning and purpose to him, it is advantageous for the occupational therapist to find a way to set up the environment in such a manner so that the client will perform to his abilities. This study also provides further evidence that meaning and purpose are important factors with the male population for exercise performance. As shown in the past research completed with a male population, this study is consistent with results demonstrating that added purpose is key to enhanced performance of exercise repetitions. This past literature was, however, conducted on a population of elderly men (DeKuiper et al., 1993; Lang et al., 1992) and on a population of men with central nervous system impairments (Hsieh et al., 1996). Our study provides further evidence that meaning and purpose are key factors to performance levels for the male population who are healthy as well as those who have an impairment.

Limitations

A major limitation to this study is that order effects were found with the group of participants who performed the imagery-based occupation first. This means that participants who performed in the imagery-based condition first had a larger mean score for repetitions and duration of exercise. Reasons for this are unknown, however, it can be speculated that these results occurred because two outliers that performed longer with the greatest number of repetitions were both part of the group that performed the imagery-based exercise condition first. The participants may have been able to simply use imagery of throwing a ball without the added

stress of physically hitting a target in front of an audience. Since the participant felt no added pressure during the imagery-based condition, they were able to perform for a longer duration with more repetitions without getting as tired as quickly as compared to the materials-based condition. Thus, participating in the imagery-based condition first may have elicited more repetition for a longer period of time compared to when they participated in the other two conditions. Another limitation of this study is that there was variability among how the participants interpreted the instructions of “stop when you are too tired.” For example, some participants interpreted the instruction to mean a physical sense of being tired. Other participants interpreted tired as a mental sense of being tired, or bored with the occupation. This is a limitation because the definition of “tired” for this study was not the same to each participant; therefore, it might have impacted the degree of performance. A third limitation is the small sample size. This sample of 30 adult males may not be large enough to generalize results to the entire male population.

Future research

More research needs to be conducted on this topic to better understand the importance of added purpose as a motivator to maximize performance during treatment. Occupational therapy is intended to use occupations of added purpose for the client to better serve them. With more research available on this topic of added purpose and motivation, the occupational therapy profession can show more reliability and validity to the purpose of the treatment methods used. Future research should be conducted using a larger sample size so as to be able to make a greater generalization across the population. This will add credibility to the results of the study. It is valuable to learn the effects of using added purpose with exercise with male populations with disabilities since patients largely consist of those persons with some type of disability. Future

studies should also investigate the difference between materials-based, imagery-based, and rote exercise on other variables such as the quality of movement, range of motion, and psychologically motivating factors (determine the meaning of the occupation to the person).

Conclusion

This study investigated the comparison of materials-based, imagery-based, and rote exercise on 30 healthy, adult males. Results indicated that when performing the materials-based and imagery-based exercise conditions significantly more repetitions were performed for a greater length of time when compared to rote exercise for the male participants. This study has added evidence that using purposeful occupation to perform an exercise with the male population may enhance performance.

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Table 1

Results

	Materials-based	Imagery-based	Rote
Repetitions			
<i>M</i>	103.83	90.40	55.50
<i>SD</i>	119.44	128.45	37.69
Range	15 – 512	13 - 567	12 - 153
Breaks			
<i>M</i>	.27	.13	.03
<i>SD</i>	.64	.35	.18
Range	0 - 3	0 - 1	0 - 1
Duration			
<i>M</i>	244.60	210.93	119.57
<i>SD</i>	273.22	334.06	83.98
Range	32 - 1159	21 - 1400	25 - 345