The Effect of Added-Purpose and Meaningful Occupation on Motor Learning

Janice M. Ferguson, Catherine A. Trombly

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Objective. Numerous studies in the occupational therapy literature have investigated the effects of added-purpose (multidimensional, goal-oriented) occupation on performance. Motor learning research has demonstrated that factors that enhance performance measures do not necessarily enhance motor learning. This study examined the effects of both added-purpose and meaningful occupation on motor learning.

Method. Twenty subjects (university students) were randomly assigned to either an added-purpose or rote exercise condition. After a skill acquisition phase, retention and transfer scores were obtained, and subjects were asked to rate the meaningfulness of the occupation on a visual analog scale.

Results. A two-way analysis of variance indicated that only the added-purpose occupation resulted in significantly greater motor learning. Additionally, the added-purpose scores were not influenced by the level of meaning assigned to the occupation.

Conclusion. This study is the first to demonstrate how added-purpose can enhance a more permanent aspect of performance: motor learning. Further research is necessary to determine whether occupations that both are meaningful and have added-purpose are the most effective in enhancing motor learning.

Occupational therapists not only use traditional motor learning principles during intervention with persons with physical disabilities (Haugen & Mathiowetz, 1995), but also believe that using added-purpose occupations rather than rote exercise will enhance the learning environment (Gliner, 1985). Yoder, Nelson, and Smith (1989) defined the term added purpose as a purposefulness that is multidimensional. For example, a person may have multiple goals in performing an occupation, such as enhanced health, increased pleasure, and the creation of a product. Embedding a therapeutic exercise within an occupation is the therapist’s attempt to add purpose to the pure exercise situation. It has been demonstrated that motor learning is influenced by “actor-oriented” variables, such as the type of practice and knowledge of results (Schmidt, 1975, 1988, 1991; Schmidt, Young, Swinnen, & Shapiro, 1989). A problem identified in motor learning theory is that it places the focus of learning on the actor and uses only one or two strategies (e.g., practice, knowledge of results) to explain the learning of a motor skill (Gliner, 1985). Not until recently have there been studies that examine the effects of what the occupation itself brings to the learning situation (e.g.,
Yuen, Nelson, Peterson, & Dickinson, 1994). There are no studies that specifically examine the effects of added-purpose occupation on motor learning.

Numerous studies in the occupational therapy literature have examined the effects of added-purpose occupation on various aspects of performance (Bakshi, Bhambhani, & Madill, 1991; Bloch, Smith, & Nelson, 1989; Kircher, 1984; Miller & Nelson, 1987; Morton, Barnett, & Hale, 1992; Riccio, Nelson, & Bush, 1990; Sietsema, Nelson, Mulder, Mervau-Scheidell, & White, 1993; Thibodeaux & Ludwig, 1988; Yoder et al., 1989). It has been demonstrated in the motor learning literature that strategies effective for improving performance, such as blocked (repetitious) practice and frequent feedback, are not always effective in the promotion of motor learning (Shea & Morgan, 1979; Weinstein & Schmidt, 1990). Therefore, it is necessary to examine whether added-purpose occupation is effective in enhancing motor learning.

It has been theorized that the purposefulness of an activity varies from person to person, depending on the meanings one assigns to it (Nelson, 1988). Researchers who have manipulated added-purpose occupation often assumed that the occupation was meaningful to the experimental group (Kircher, 1984; Riccio et al., 1990; Sietsema et al., 1993; Yoder et al., 1989). However, purpose depends on meaning, not vice versa (Nelson, 1988). Thus, we cannot assume that when we add purpose to an occupation, we also make an impact on meaning. Some researchers who compared the performance of added-purpose occupation and rote exercise groups suggested that a lack of affective meaning for the added-purpose occupation may be the reason for not finding significant differences (Bloch et al., 1989; Thibodeaux & Ludwig, 1988). It is important when measuring the effects of added-purpose occupation on motor learning to also measure the individual and interactive effects of meaning.

**Added-Purpose Occupation**

In occupational therapy, purposeful activity or occupation has been defined as "goal-directed behaviors or tasks that comprise occupations...[that] build upon the individual's abilities and lead to achievement of personal functional goals" (American Occupational Therapy Association [AOTA], 1993, p. 1081). Occupational therapists use purposeful occupation to “evaluate, facilitate, restore, or maintain individuals’ abilities to function in their daily occupations” (AOTA, 1993, p. 1081). Nelson (1988) described purpose as “the goal orientation of the individual and the link between the individual’s developmental structure and occupational performance” (p. 636). The term added-purpose occupation implies that the occupation is multidimensional and has more purpose for the person other than that of therapeutic exercise (Yoder et al., 1989). Purposefulness varies from person to person: “Dependent on the meanings assigned to the occupational form by the individual, the individual purposefully organizes his or her structural characteristics in such a way as to achieve a goal through occupational performance” (Nelson, 1988, p. 636). Figure 1 depicts the relationship among purpose, meaning, and the other aspects of occupation according to Nelson (1988).

Kircher (1984) was the first to examine the effects of added purpose when she compared the perceived exertion of 26 women randomly assigned to two conditions: a single-purpose occupation (jumping) and an added-purpose occupation (jumping rope). To be selected for the study, the women had to (a) report that they enjoyed competence at jumping rope as a child and (b) demonstrate competence in the activity during a 1-min pretest. The study revealed that heart rate at a given level of the subjects’ perceived exertion was significantly higher for jumping rope than for jumping in place. Duration of rope jumping was greater than that for jumping without a rope, but not significantly. Kircher interpreted the findings to mean that adding purpose gave the subjects who jumped rope added intrinsic motivation, resulting in their jumping longer and perceiving exertion at a higher physiological level.

Bloch et al. (1989) repeated Kircher’s (1984) study with three additional components: (a) a standardized target zone formula was used to determine the individual subject’s maximum safe exertion; (b) subjects were asked their activity preference; and (c) affective meanings of jumping with and without a rope were measured with the short form of Osgood’s Semantic Differential. Their results supported Kircher’s study in demonstrating a significantly higher increase in heart rate at a given level of perceived exertion for the subjects jumping with a rope (added-purpose condition). In contrast to Kircher’s study, 20 of the 30 subjects jumped longer without a rope, but not significantly. In addition to these findings, the authors found that 16 subjects preferred jumping with the rope, 13 preferred to jump without the rope, and I had no preference. Furthermore, there was no significant difference in the measure of affective meaning between the two conditions. Bloch et al. proposed that the differing and mixed results may have been due to the addition of the imposed target zone formula. The findings regarding activity preference suggest that the mixed results may also have been due to the fact that the number of subjects preferring to jump with a rope was not significantly greater than the number of subjects preferring to jump without a rope. The conditions of added purpose and meaningfulness or preference may have imposed separate or interactive effects on performance. This study demonstrated the importance of separating the variables of purpose and
meaning as well as the importance of investigating their separate and interactive effects on motor learning.

**Meaningful Occupation**

The importance of meaning has been acknowledged in occupational theory. Kielhofner (1992) asserted that it is important that occupations used in therapy are also meaningful to clients. Nelson (1994) described meaningfulness as having to do with making sense of the occupational form (i.e., physical and sociocultural dimensions of an occupation) as well as pertaining to feelings elicited in the context of that occupational form; that is, "Once a person finds meaning in an occupational form, a sense of purposefulness is possible" (p. 23). This feeling, or affective meaning, is the type of meaning thought to be important for enhancing performance in the added-purpose studies mentioned previously (i.e., Kircher, 1984; Siersema et al., 1993; Yoder et al., 1989). In a study comparing affective responses to activities, Boyer, Colman, Levy, and Manoly (1989) demonstrated that affective responses to an activity differed before and after engagement. These authors' findings highlight the importance in the present study of measuring meaningfulness after actual participation in the occupation. No studies were found in the occupational therapy literature that examined the effects of meaningful (affective meaning) occupation on motor learning.

**Motor Learning**

Optimal motor learning is thought to be affected by the quantity and quality of cognitive processing demands made available to the person (Shea & Zimney, 1983, 1988). Researchers have demonstrated that various actor-oriented conditions can influence this quality and quantity of cognitive processing, namely, the type of practice and the frequency and type of knowledge of results (Bilodeau & Bilodeau, 1958; Gabriele, Lee, & Hall, 1991; Lee & Magill, 1983, 1985; Schmidt et al., 1989; Shea & Morgan, 1979; Sherwood, 1988; Weeks, Reeve, Dornier, & Forber, 1991; Winsen, 1991). These researchers measured motor learning in terms of motor skill retention and transfer. Retention and transfer were measured through testing performance after a controlled rest period. A person may be able to perform a task well immediately after a practice session but can only be said to have retained the motor skill if he or she can perform it again at a later date. The person’s ability to perform a new, but similar task is called transfer of the motor skill.

Motor learning research to date cannot account for how motor learning takes place in more realistic and complex situations. It has not identified what factors contribute to the learning of a motor skill other than practice and knowledge of results (Gliner, 1985). Gliner asserted that the event approach to motor learning, where the performer and the environment (object and task) are thought of as a unit, adds meaning and purpose to support the performer’s actions. Added-purpose occupation would emphasize the benefits of focusing the performer on the multi-dimensional outcomes or goals of the task rather than on the internal aspects of his or her performance.

Occupational therapists have begun to study the effect of added-purpose occupation on performance, but research is needed to examine the separate and interactive effects of meaningful and added-purpose occupation on more permanent aspects of performance, such as motor learning. This information will assist occupational therapists in affording their clients an environment that will better enhance learning.
Method

Design

A 2 × 2 factorial design was used in order to study the independent and interactive effects of added-purpose (active) and meaningful (attribute) occupation on retention and transfer of a motor skill (Kerlinger, 1986). Each subject was assigned randomly to one of two conditions: the added-purpose occupation or the rote exercise (see Figure 2).

Subjects

Twenty right-hand dominant students from the program of occupational therapy at Sargent College of Boston University volunteered to participate in the study. All were naive to the purpose of the study, and none had taken a specific course on motor learning theory. The subjects were randomly assigned to added-purpose and rote exercise conditions and later regrouped according to their ratings of the meaningfulness of the occupation (see Table 1).

Instrument

Motor skill retention and transfer were measured through the number of errors each subject incurred during the production of a musical tune on an electric keyboard. The tunes were tape recorded, and errors were defined as inaccuracy of finger placement on the keys and improper sequencing of keys. Errors were counted twice to ensure reliability. Finger placement errors were evidenced by the production of two simultaneous notes (i.e., two keys touched on the keyboard instead of one). Sequencing errors were evidenced by the sound of an incorrect note when compared with the correct tune. Either type of error was counted as one error.

A visual analog scale was developed to rate the meaningfulness of the task. The scale ranged from 0 (not meaningful) to 10 (very meaningful). No reliability information was determined for this scale, and "meaningfulness" was not defined for the subjects.

Procedure

A brief orientation to the study was provided to each subject before obtaining informed consent. The subjects were informed that the study was examining the effect of varying occupational demands on the acquisition of a motor skill.

![Figure 2. Experimental design.](http://ajot.aota.org/pdfaccess.ashx?url=/data/journals/ajot/930018/)
Table 1
Demographic Characteristics of Subject Groups

<table>
<thead>
<tr>
<th>Group</th>
<th>Gender</th>
<th>Agea</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>Added-purpose occupation</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Rote exercise</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Low meaning</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Neutral meaning</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>High meaning</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

aAge range = 21-27 years.

After random assignment to either the added-purpose or rote exercise condition, each subject was seated in front of the experimental setup (see Figure 3). The environment was identical in both conditions, including the electronic keyboard. The keyboard was camouflaged in both conditions in an effort to conceal from the rote exercise group the fact that it was a musical instrument. The added-purpose condition required the subjects to practice three five-note patterns to produce a musical tune. The rote exercise condition required the subjects to practice the same three five-note patterns but for the purpose of learning a motor pattern without the production of a tune. Both conditions were practiced in a random sequence, and subjects were not given verbal feedback about their performance or results. All subjects were given standardized, verbal instructions, with the main difference in instructions between the groups being the description of the purpose of the activity.

A total of 54 acquisition trials were completed. The subjects rested for 30 min after the trials to allow temporary effects, such as fatigue or boredom, to dissipate. During the break, a snack was provided, and the subjects worked on a jigsaw puzzle or school work in a supervised environment in order to prevent mental rehearsal of the experimental task. After the break, the subjects were asked to perform, from memory, the three tunes or patterns they had practiced. They were not provided the color-coded tune or pattern that had been positioned below the signal light present during the acquisition trials. In contrast to the acquisition trials, all subjects were given musical feedback when they completed the tune or pattern during the retention and transfer trials in order to ensure that the tasks were common to both groups. During the retention trials, the signal light cued, at random, the subjects to perform the three tunes two times each. Performance was tape recorded.

Transfer of the motor skill was measured after the retention trials. Each subject was tested on three trials of one new tune. The novel five-note tune was the same for both experimental groups. The tune was color-coded and posted below a signal light. When the signal light went on, the subjects played the new tune. Again, performance was tape recorded. Immediately after the transfer trials, each subject was asked to rate the meaningfulness of the task on the visual analog scale. The subjects were then asked to explain their rating and to describe why the task was or was not meaningful to them.

Data Analysis
The raw tape-recorded data were analyzed for errors, and the number of errors was averaged over the six trials for retention and the three trials for transfer of the motor skill for each subject. Error scores for both sets of trials were analyzed and tested for significance with a two-factor analysis of variance (activity type × meaningfulness). The interaction effects of added purpose and meaningfulness also were analyzed.

Figure 3. Experimental setup.
Ratings from the visual analog scale did not indicate absolute quantities nor that the intervals between the ratings were equal (Kerlinger, 1986). Because the ratings obtained with the visual analog scale were probably not continuous, they were categorized into three groups: low meaning (0–3), neutral meaning (4–6), and high meaning (6–10). Neutral meaning was included as a category to take into account the frequent occurrence of errors of central tendency in ordinal scales.

Results

The subjects in the added-purpose condition demonstrated significantly fewer errors than the subjects in the rote exercise condition during retention but did not demonstrate significantly fewer errors at transfer. The high meaning group did not demonstrate significantly fewer errors than the low meaning group at retention or during transfer (see Tables 2 and 3). No interaction was found between purpose and meaning for either retention or transfer of the motor skill (see Table 3).

Discussion

The present study provides evidence that the use of added-purpose occupation, which has been shown previously to result in enhanced performance measures, results in greater motor skill retention. This result supports added-purpose occupations for the development of motor learning in populations with no motor or cognitive deficits. One reason that added-purpose occupation resulted in greater retention may be because of differences in knowledge of results offered by the two tasks. Kircher (1984) and Gliner (1985) both hypothesized that added-purpose occupations may be more effective in enhancing performance and motor learning because of their inherent ability to provide the learner with knowledge of results. Added-purpose occupation is designed to focus the learner on the multidimensional outcomes of his or her performance, whereas rote exercise focuses the learner on individual movements. The motor learning literature has stated that knowledge of results is one of the strongest variables affecting motor learning (Bilodeau & Bilodeau, 1958; Nicholson & Schmidt, 1989; Sherwood, 1988).

In contrast to skill retention, no significant differences in transfer of the motor skill were demonstrated between the added-purpose and rote exercise conditions. The transfer of the motor skill occurred in both groups, but the nearly perfect scores of all subjects precluded any significant differences from being observed between groups. The high scores of all subjects on the transfer task would suggest that the transfer task was not challenging enough to demonstrate variation in performance among subjects. This phenomenon is known as a ceiling effect (Schmidt, 1988).

The subjects who perceived the experimental condition to be highly meaningful did not demonstrate significantly greater motor skill retention than the subjects who perceived the condition to have low meaning. Although the results were not significant, they were in the direction of the original hypothesis. The greater motor skill retention in the high meaning group could reflect the interpretation made by Hyvarinen and Poranen (1974) in their study of the function of the parietal association area of the cerebral cortex. These researchers studied the physiological aspect of reaching in six nonanesthetized, alert female stump-tailed monkeys. More specifically, the responses of 193 cells, histologically localized to Brodmann's area 7 in the parietal associative area, were studied during manual reaching, tracking, and manipulation. Results demonstrated that sensorimotor neurons in Brodmann's area 7 discharged only during active reaching for objects of motivational interest (e.g., a raisin). On the basis of their results, the researchers concluded that the normal function of cells in this region was to convey visual and somesthetic signals from the opposite side of the brain to the sensory and motor systems for directing motor responses to targets. In the present study, the high meaning occupation may have enhanced motor learning by activating the cells responsible for conveying signals from the parietal association area to the motor system in order to direct the motor response to the target. The low meaning occupation may not have activated these cells; therefore, the subjects did not perform as well on retention. No significant differences were found between the high and low meaning groups for the transfer scores for reasons previously explained.

The lack of a significant difference between high and low meaning groups may have occurred for many reasons. In manipulating "purpose," the researcher had little control over the type and level of meaning the subjects assigned to the two conditions. The variable of meaning was not manipulated or controlled but was measured after performance took place. Thus, the impact of meaning depended on the level of interest, importance, value, and so forth that the subject held for the activity. Although some subjects reported a high level of meaningfulness for the

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Table 2
Descriptive Data Scores

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<thead>
<tr>
<th>Group</th>
<th>Retention</th>
<th>Transfer</th>
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<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Added-purpose</td>
<td>1.6</td>
<td>1.0</td>
</tr>
<tr>
<td>Rote exercise</td>
<td>3.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Low meaning</td>
<td>3.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Neutral meaning</td>
<td>2.6</td>
<td>1.2</td>
</tr>
<tr>
<td>High meaning</td>
<td>2.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*Significant difference (p < .004) in retention scores between the added-purpose occupation and rote exercise groups.
added-purpose and rote exercise tasks, it may have been restricted by the artificial nature of the occupations. Another limitation may have been that the subjects rated meaningfulness in front of the researcher. Some subjects may have rated the occupation as highly meaningful in order to please the researcher. This reactive effect of testing would have affected the validity of the results.

The lack of interaction between the variables of purpose and meaning reinforces that added-purpose occupation singularly enhanced motor learning. The effects of added-purpose occupation did not depend on the level of meaning perceived by the subjects. The subjects who rated an added-purpose or a rote exercise occupation as highly meaningful explained that their rating was due to reasons such as the occupation being game-like and fun, the high value they place on research, or their good rapport with the researcher. Meaning was often not tied to the purpose of the occupation but to the subjects' larger contextual experience. This finding is supported by Bloch et al. (1989) who found that the added-purpose occupation was not any more meaningful to the subjects than the rote exercise. Meaningfulness of the added-purpose occupation to the subjects was not ensured by the researchers before the study. Nelson (1988) stated that an occupation that is meaningful in turn purposeful, not vice versa. The lack of interaction found in the present study supports his model. If meaning had been considered in the added-purpose occupation (e.g., a tune having meaning to the subject), an interaction may have been found.

Implications for Occupational Therapy Practice

The impact of these findings on occupational therapy practice is threefold. First, it is important to use added-purpose occupations that focus the client on the outcome of his or her performance rather than on individual movements. This natural focus on the outcome probably provides the client with knowledge of results about his or her performance that greatly enhances motor learning. Second, because occupational therapy theorists assert that it is important to use only occupations that are meaningful to our clients (Kielhofner, 1992), we must not confuse or assume that occupations that have an added purpose are also meaningful. Third, occupations that both are meaningful and have added purpose may be the most effective in enhancing motor learning, and this needs to be studied. Before such a study can be undertaken, occupational therapists must develop an operational definition of meaningfulness and a method of measuring it.

Conclusion

This research demonstrated that added-purpose occupation resulted in greater motor skill retention than rote exercise in a young, primarily female, student population. Because a ceiling effect may have prevented the demonstration of significant differences in the transfer of the motor skill, further research can examine transfer with a more challenging task. Further research can also include persons with occupational dysfunction in order to be confident that these results are valid for populations that require occupational therapy intervention. Because we as occupational therapists believe that occupations used in practice must be both meaningful and purposeful to our clients (Kielhofner, 1992), we should investigate the benefits of using meaningful occupation on additional permanent aspects of performance other than motor learning. Permanent aspects of performance could include the learning of complex occupations or the acquisition of roles. For meaningful occupation to be manipulated or measured in a study, it is essential that meaningfulness be explicitly defined. Kielhofner (1992) and Nelson (1994) are two theorists who have already accepted this challenge. More specificity is required to make the construct of meaningful occupation clearer to the entire profession of occupational therapy.

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References


