The Effect of Self-Modeling on the Performance of Beginning Swimmers

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The present study compared the effects of two types of modeling, self- and other-modeling, on learning elementary swimming skills. Specifically, potential differences between the two modeling conditions in swimming performance, swimming self-efficacy, and state anxiety were investigated. Participants were adult volunteers from a college community. Ages ranged from 20 to 58. Each participant took five individual swimming lessons. Results indicated that participants in the self-modeling condition demonstrated better swimming performance by the fourth swim session than participants in the other-modeling condition. No differences were found between modeling conditions on either swimming self-efficacy or state anxiety. Potential reasons for the difference in performance are identified and discussed.

The use of videotape as a teaching tool has become widespread and provides an exciting way to impart information about the way a skill is performed. Most teachers and coaches that use this tool as an aid would concur that it creates changes in behavior, although the exact mechanisms are not fully understood. Speculations concerning the processes underlying observational learning become more complex with videotape because it is a technique that can be easily manipulated through editing. It also makes it easy to observe one's own performance, which is a distinctly different phenomenon than observing someone else. The following study investigates the relationship of watching oneself versus someone else on videotape and its subsequent impact on performance. In addition to performance, it also examines whether the experience of watching yourself, versus observing someone else, differentially affects the psychological variables of self-efficacy and anxiety.

Even prior to videotape technology, the use of observation as a facilitator of learning was not new to psychology. According to Bandura (1986, 1997), most forms of human behavior are learned by observation. Through observation, one

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acquires general rules or conceptions of how to act and behave in various situations that may be enacted at a later time. Thus, modeling is not a form of mimicry but a learning process that allows the observer to perform novel behaviors that were not previously in his or her repertoire. The effectiveness of this observational learning process is affected by four variables: the learner's attention, retention, production, and motivational processes. In addition to influencing performance, modeling may also influence psychological characteristics such as self-efficacy and anxiety. According to McCullagh, Weiss, and Ross (1989), these social-psychological variables interact with the type of feedback provided to influence behavior.

As can be seen, observational learning is a complex phenomenon. To further understand the numerous parameters affecting modeling, some researchers have begun to study the effects of self-observation on learning and performance, as well as the influence of highlight videos on sport performance (e.g., Halliwell, 1990; Templin & Vernacchia, 1995). In a review of self-observation techniques, Hosford (1980) reports that the positive consequences of viewing oneself are increased self-acceptance, increased arousal, more openness to feedback, and less use of denial as a coping strategy. Others postulate that self-observation may not be an entirely positive experience if participants tend to focus on the negative aspects of their appearance or performance (Alkire & Brunse, 1974; Hosford, 1980; Kimball & Cundick, 1977). To date, the most comprehensive look at the effects of observing oneself on videotape was conducted in the sport skill literature by Rothstein and Arnold (1976), who reviewed over 50 studies on the effectiveness of videotape replay. Surprisingly, only 19 of the studies found this self-observational learning technique to be an effective teaching tool. According to Newell (1981), the lack of strong empirical support for videotape feedback is probably due to poor experimentation combined with an overemphasis on the role of videotape in skill learning. When viewing videotape feedback, both correct and incorrect performances are included, and recent evidence (Bradley, 1993) has shown that viewing one's own deficiencies has detrimental effects on performance. Nevertheless, the equivocality of the research regarding the effectiveness of videotape feedback suggests the need for additional research.

One type of observational learning that seems to circumvent the problem of indiscriminate use of videotape feedback is self-modeling. Self-modeling is defined as "a procedure in which people see themselves on videotapes showing only adaptive behavior" (Dowrick, 1983, p. 105). Thus far, much of the original work on self-modeling has been done in the clinical field. For example, after other standard interventions had failed to help an adult male with his stuttering problem, Hosford (1980) edited an audiotape of the male speaking with the stuttering deleted. After the speaker listened to the edited tape, his stuttering decreased. Around the same period of time, C镜子 and Miklich (1979) used a self-modeling procedure to improve socially maladaptive behavior.

Self-modeling has also been successful in situations that are much less clinically oriented. Maile (in Franks & Maile, 1991) used self-modeling to train a nationally ranked power-lifter. Edited videotapes of the athlete lifting more than she could actually physically lift were shown to the athlete prior to training sessions. Viewing these tapes produced such substantial gains in performance that no additional gains were made through training in the next 4–6 weeks following the intervention. Dowrick (1991) would call this type of self-modeling "feedforward," because participants were viewing potential behavior, not just edited versions of correct behavior that they had already performed.
Feedforward methods of self-modeling can be contrasted with "positive self-review," which consists of editing adaptive behaviors that the participant has already enacted onto the self-model videotape. For example, Dowrick and Dove (1980) used positive self-review to enhance swimming performance in children with spina bifida. Three children were followed in a time-series design, which demonstrated that swimming performance moderately improved following each viewing session of edited videotapes in which the children only saw their successful swimming behaviors.

Although many researchers provide evidence that self-modeling is an effective procedure for modifying behavior, only a few have attempted to compare its effectiveness with other interventions (Bradley, 1993; Dowrick, 1983; Meharg & Woltersdorf, 1990). Schunk and Hanson (1989) made the argument that the effectiveness of self-modeling relative to other forms of performance enhancement is due to an increase in the learner's self-efficacy. In a series of three experiments, they found that improvement in skill was directly paralleled by increases in self-efficacy. Schunk and Hanson (1989) thus argue that self-efficacy is an important mediator in the self-modeling process.

These explanations of the effectiveness of self-modeling by self-efficacy theory are consistent with Bandura's social learning theory. According to Bandura (1997), perceived self-efficacy operates independently of underlying skills. It has to do with the judgment of one's capabilities to perform the skill, not with the actual ability that one possesses, although these could be highly related (Bandura, 1986). According to Bandura, efficacy information is derived from four sources: enactive attainment (previous performance), vicarious experiences, verbal persuasion, and physiological states. Of these sources, past performance is the strongest mediator of efficacy (Bandura, 1986). The differences in the strength of efficacy information have implications for the modeling literature. Specifically, if past performances are a stronger source of efficacy than watching someone else perform a skill (vicarious experience), perhaps watching oneself perform a skill flawlessly (self-modeling) would be more beneficial than observing a peer model.

Few studies have attempted to compare the effectiveness of peer modeling versus self-modeling. Additionally, the only studies that have attempted to parcel out self-efficacy from instructional effects in self-modeling are the Schunk and Hanson study cited earlier (1989) and an unpublished experiment conducted by Gonzales and Dowrick (1982). The results of the work by Schunk and Hanson (1989) and Gonzales and Dowrick (1982) do not seem to coincide with the conclusions made about self-modeling by Meharg and Woltersdorf (1990) in their review of the therapeutic use of self-modeling. According to their review, the specific factors that set self-modeling apart from other forms of modeling are unclear, yet self-efficacy may account for a large part of its effectiveness. They point out that little theoretical research has been done in this area, and that there is a need to understand the mechanisms involved with self-modeling.

The present research is an attempt to investigate some of these theoretical questions about self-modeling. Specifically, a sport skill, swimming, is used to compare the effectiveness of peer modeling and self-modeling as teaching aids, with the intention of understanding how self-efficacy interacts with each of these modeling conditions. Swimming was chosen for several reasons. First, Dowrick and Dove (1980) have already demonstrated that self-modeling is a viable technique for enhancing swimming performance. Second, as demonstrated by the motor skill literature, there is a strong relationship between self-efficacy and performance.
of sport skills (Bandura, 1997; Feltz, 1982; McAuley, 1985). Generally, the higher one's self-efficacy, the better the performance, and vice versa (Weinberg, Gould, & Jackson, 1979). Additionally, it has been demonstrated that mastery performances increase self-efficacy in adult beginning swimmers (Hogan & Santomier, 1984; Theodorakis, 1995). It can also be argued that learning to swim as an adult poses a tremendous challenge and is likely to be an anxiety-provoking experience, as well as a task in which efficacy may play an important role.

The purpose of the present study is to compare the effectiveness of using self-modeling versus other-modeling in the learning environment. Second, any differences in self-efficacy and anxiety between the two modeling conditions will be examined. Considering the widespread endorsement of self-modeling as a viable technique for enhancing the acquisition of skills (Bandura, 1986, 1997; Dowrick, 1983, 1999), several hypotheses were made. In terms of performance, it was predicted that adult beginning swimmers who observed self-model tapes of their swimming performance would improve their swimming skills more than beginning swimmers who observed videotapes of other models swimming. Additionally, the self-modeling group would have higher self-efficacy, as measured by the Swimming Self-Efficacy Scale, than the other-model group. A further prediction was that self-modeling would reduce the state anxiety of the swimmers, with the reduction of anxiety in the self-modeling group being greater than the anxiety reduction produced in the other-modeling situation.

Method

Participants

Eight women and two men, ages 20 to 58, participated in the study. All were from a college community and classified themselves as beginning swimmers. They were recruited with signs posted at recreation centers or through university classes. The range of initial swimming abilities spanned from not knowing how to float to being able to swim a 15-yd crawl stroke. No participant, however, could swim a 25-yd crawl stroke prior to being in the study. Participants volunteered their time in exchange for receiving free swimming lessons. Because each participant received multiple treatments, as well as an individual treatment designed specifically for him or her, it was prohibitive to test a greater number of people.

Instrumentation

Swimming performance was measured by a Swimming Performance Checklist similar to the Rhode Island Adapted Aquatics Program used by Dowrick and Dove (1980). The checklist was modified to be applicable to adults. Specific skills were taken both from the Rhode Island Adapted Aquatics Program and from the American Red Cross beginner and advanced beginner swimming courses. The difficulty of skills ranged from getting into the water without hesitation, to a front float, to diving into deep water and swimming one length of the pool (25 yd). As described in the next paragraph, independent observers selected 25 skills for each participant to compose their individualized Performance Checklist. Swimmers were videotaped performing these 25 skills and later received a score of 0 to 100 (in increments of 10) for each skill, as determined by two judges familiar with swimming skills. The judges scored the swimming performances independently, and a measure of interrater reliability was taken to ensure an accurate scoring
system. A score of 0 indicated that no attempt was made to perform the swimming skill. A score of 100 meant that the skill was performed with perfect form. Scores of 10 through 90 indicated relative amounts of success in performing the swimming skill. For example, with a skill such as the front float, a 30 would be awarded if the person floated with the instructor’s help; a 50 would indicate that swimmers attempted to float by themselves but were not very successful. A score of 80 would indicate that the swimmers performed the skill by themselves but could not maintain the float for the amount of time indicated on the checklist. The total score for swimming performance was the average of the sum of scores awarded for each individual skill. Thus, the minimum score was zero (no points for any of the 25 skills), and the maximum score was 100 (a score of 100 on each of the 25 skills).

To control for individual differences in swimming ability, each participant had a different set of 25 skills that was used to rate performance. The 25 skills were selected by two independent observers who watched a videotape of the initial swimming session. During that session, the instructor systematically had the swimmer attempt 64 skills, from very elementary swimming behaviors, such as blowing bubbles in the water, to the more advanced skill of swimming a length of the pool. The independent observers rated the person’s performance on each of the skills on the same 0–100 scale used for the Swimming Performance Checklist. Based on the raters’ assessment of the participant’s performance on those skills, 25 were chosen for each person. Specifically, the 10 most difficult skills that the person attempted, but received a score of less than 10 for the skill, were put on their individual checklist. Additionally, the next 15 skills, in order of increasing difficulty, that the participant could not perform were placed on the 25-skill checklist. As a result, over the course of the experiment each participant would be rated on 25 skills, a minimum of 10 of which they had attempted but not perfected, and 15 of which they could not perform at all.

Swimming Self-Efficacy Scale. A Swimming Self-Efficacy Scale was created to measure participants’ efficacy to perform the skills measured by the Swimming Performance Checklist. Therefore, participants rated their efficacy to perform the 25 skills that were on their individualized Performance Checklist. The range of individual items included the following: (1) put face in water (easy skill level); (2) front glide with kick, 5 yd (moderate); (3) swim 15 yd front crawl (difficult). The scale was constructed according to guidelines presented by Bandura (1977). Strength of efficacy for swimming was determined by having participants respond to each possible skill with a percentage value of their perceived confidence in their ability to perform that skill. A percentage value of 100 indicated that the person was entirely certain that he or she could perform the swimming skill. A percentage value of 0 indicated that they were not at all confident in their ability to perform the skill. Scores between 0% and 100% indicated relative degrees of certainty in their ability to perform the swimming skills. The percentage values were then summed and divided by the number of skills (25) to ascertain strength of efficacy. Level of self-efficacy was determined by the total number of times that a person responded with greater than 0% confidence.

The State Trait Anxiety Inventory (STAI). The STAI is a self-report measure that evaluates both state and trait anxiety (Spielberger, 1972). The STAI was used instead of the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Vealey, & Burton, 1990) to rate state anxiety because the CSAI-2 tests anxiety relative to competitive situations, and learning to swim was not assumed to be
competitive, because each person received individual instruction. The STAI A-State scale consists of 20 statements that ask people to describe how they feel at that particular moment. Participants respond to each item by rating themselves on a scale of 1 to 4, with 1 indicating that this is not at all how they feel, 2 indicating that this is somewhat how they feel, 3 moderately so, and 4 very much how they feel. Reliability for the STAI is .51 for men and .36 for women. This relatively low reliability is acceptable for state measures because it reflects the influence of situational factors. Internal consistency is uniformly high for all items, with all but one of the state anxiety alpha coefficients being above .90. The validity of the scale is well documented in the Manual for the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Lushene, 1970).

**Video Equipment.** A Panasonic videotape camcorder was used to record all phases of the experiment. Editing was done on a Panasonic video-editing system. A 10-in. Sony black-and-white television was used to show the participants the modeling tapes.

**Experimental Design**

Participants were randomly assigned to either a self-model group or a peer-model group. Both groups participated in five swimming lessons. During the first two sessions, there was no difference in interventions between the two conditions. The first lesson was used to assess the person's swimming skill and subsequently served as the basis for creating the individualized performance checklist. During the second session, all participants received videotape feedback (VTFB) from performances recorded during the first lesson. In addition to providing initial assessment information, these sessions served as a baseline control from which changes in swimming performance, swimming self-efficacy, and state anxiety were calculated once the two modeling interventions were introduced. During the third and fourth swimming lessons, the differential modeling conditions were employed. A fifth swimming session was added that involved no experimental manipulation. Because only the third and fourth lessons were used as interventions, the design for purpose of analyses was a 2 (modeling) × 2 (session) design (see Table 1).

**Table 1 Experimental Design**

<table>
<thead>
<tr>
<th>Swim session</th>
<th>Self-model</th>
<th>Other-model</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Assessment via 64-item checklist</td>
<td>Assessment via 64-item checklist</td>
</tr>
<tr>
<td>2</td>
<td>3-min VTFB; SE scale; STAI; perform individualized 25-item list</td>
<td>3-min VTFB; SE scale; STAI; perform individualized 25-item list</td>
</tr>
<tr>
<td>3</td>
<td>3-min self-model; SE scale; STAI; perform 25-item list</td>
<td>3-min other-model; SE scale; STAI; perform 25-item list</td>
</tr>
<tr>
<td>4</td>
<td>3-min updated self-model tape; SE scale; STAI; perform 25-item list</td>
<td>3-min updated other-model tape; SE scale; STAI; perform 25-item list</td>
</tr>
<tr>
<td>5</td>
<td>Private swim lesson</td>
<td>Private swim lesson</td>
</tr>
</tbody>
</table>
Procedure

Participants were contacted either by phone or in person and were informed that the purpose of the study was to investigate a new way of teaching swimming skills. They were introduced to the swim instructor and told of her credentials for teaching swimming. She had been teaching swimming for 10 years and was a certified U.S. swimming coach for an age-group team. Subsequently, she was experienced in providing an emotionally and physically safe environment in which to learn. The pool, which is affiliated with a major university, was unoccupied, with the exception of the instructor, the participant, and a person filming the lesson on videotape, who was also a certified lifeguard. The instructor was in the water at all times. Participants signed an informed consent, as well as a waiver that allowed us to use their videotapes for the purpose of the experiment.

During the first session, participants completed both the STAI-state questionnaire and the Swimming Self-Efficacy questionnaire. Participants then attempted to perform as many of the 64 skills on the initial Swimming Performance Checklist as they were capable of doing (e.g., put head underwater, kick legs [prone] holding instructor’s shoulders). For the remainder of the time, the swim instructor helped the person learn to perform some of the swimming skills, starting with the basic tasks and working toward the more difficult skills. Instruction on the task included verbal guidance and minimal physical assistance in performing the skills. Thus, the instruction was “guided” as opposed to “discovery” learning (Schmidt, 1988). Despite the fact that all participants were beginners, the skill level among the swimmers varied considerably. Thus the instructor did not spend time covering skills the participant had already acquired. The skills that were taught, however, were presented in the order in which they appeared on the Swimming Performance Checklist. The entire lesson was videotaped.

Prior to the second swim lesson, independent observers viewed the tape of the first lesson and rated the swimmer on each of the skills. Based on the ratings, a 25-item Swimming Performance Checklist was developed, which would serve as the guideline and rating scale for that participant for the rest of the lessons.

At the beginning of the second swim lesson, videotape feedback was provided for all participants, regardless of the modeling condition to which they were assigned. The tape consisted of 3 min of the previous swimming lesson. The 3-min time segment was selected based on pilot testing and on Dowrick’s (1991) guidelines on the most effective way to use videotape. The specific content of these tapes consisted of a segment of the previous lesson, which showed four swimming behaviors that the participant performed correctly, and four behaviors that the participant had trouble performing. This type of feedback is characteristic of the way videotape feedback is given in sport situations (Rothstein & Arnold, 1976). The purpose of using videotape feedback for all participants was to provide a control condition where participants saw themselves on videotape without actually receiving the self-modeling intervention. After watching the feedback videotape, participants once again completed the Swimming Self-Efficacy questionnaire and the STAI-state form. The swim lesson then proceeded like the first one except that the participant only attempted to perform the selected 25 skills, as opposed to the initial 65.

During the third and fourth swimming lessons, the intervention was different for the two modeling conditions. Prior to the swim lesson, the self-model group watched a self-model videotape (3 min long) that showed them successfully performing a number of the swimming skills. Specifically, these skills included
performances that they emitted during the previous swimming lesson. Conversely, the peer-model group watched a videotape of the peer model performing skills that matched their own ability level. The peer was a 30-year-old female advanced beginner swimmer who was able to perform all the skills. However, on watching the video it was obvious that she was not an expert. Thus, they watched someone else perform skills that they were capable of performing but did not watch themselves perform the swimming skill. By using this format, participants in both groups received similar information. After viewing the videotapes, participants in both groups completed the state portion of the STAI and the Swimming Self-Efficacy questionnaire prior to proceeding with their swim lesson.

After completing the first four swimming sessions, all participants received a fifth swimming lesson that was entirely for the participants’ benefit. During this session, the instructor was able to spend additional time working with the person on skills that had posed difficulties for him or her. Participants were also fully debriefed at this time.

Results

Measures of interrater reliability between the two judges familiar with swimming skills were taken to determine the consistency of scoring on the performance ratings. The judges’ ratings of performance were highly correlated ($r = .84$); therefore the performance ratings of the two judges were averaged. Scores for performance ranged from 0 to 100. Judges were blind to experimental conditions and sessions.

Because the second swim session was a baseline measure of performance, anxiety, and self-efficacy, t tests were conducted between groups on each dependent measure to ensure that there were no significant differences between groups prior to the introduction of the different modeling conditions. No significant differences were found between the self-modeling condition and the other-modeling condition on initial performance, anxiety, or self-efficacy.

Because the research hypotheses were established for individual dependent variables and not for an overall linear combination of dependent variables, univariate analyses were conducted for each of the dependent variables across swim sessions. Means and standard deviations for these analyses appear in Table 2.

Specifically, a 2 (modeling condition) × 2 (swim session) repeated-measures analysis of variance (ANOVA) was conducted to test for potential differences in performance. Results indicated that there was a significant difference in performance between modeling conditions, $F(1, 8) = 5.12, p = .05$, with the self-modeling group performing better than the other-modeling group. There was also a significant difference in performance for the different swim sessions, $F(1, 8) = 10.24, p < .01$, with participants performing better on the fourth than on the third session. Finally, there was a significant interaction, which superseded the main effects, between the modeling conditions and swim sessions, $F(1, 8) = 7.43, p < .05$, as illustrated in Figure 1. A test of simple main effects indicated that there was a significant difference in performance between the self-model and other-model conditions during the fourth swim session, $F(1, 8) = 8.01, p < .05$. Specifically, means indicated that participants in the self-modeling condition performed better than participants in the other-modeling condition. The test of simple main effects also indicated that there was a significant difference in performance for the self-modeling condition between the third and fourth swim sessions, $F(1, 8) = 17.42, p < .01$. Means indicated that swimming performance for participants in the
Self-modeling condition improved from the third to the fourth swimming session, whereas the swimming performance of participants in the other-modeling condition remained relatively unchanged.

Two additional 2 (modeling condition) × 2 (swim session) repeated-measures ANOVAs were conducted to test for differences in self-efficacy and anxiety in the self-model and other-model conditions. No significant differences were found.

Table 2  Means and (Standard Deviations) for Performance, Anxiety, and Self-Efficacy Across Swim Sessions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Performance</th>
<th>Anxiety*</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Session 2</td>
<td></td>
</tr>
<tr>
<td>Self-model</td>
<td>41.5 (15.9)</td>
<td>37.0 (9.9)</td>
<td>65.1 (12.8)</td>
</tr>
<tr>
<td>Other-model</td>
<td>33.9 (12.7)</td>
<td>31.0 (9.3)</td>
<td>49.4 (25.5)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Session 3</td>
<td></td>
</tr>
<tr>
<td>Self-model</td>
<td>51.0 (9.9)</td>
<td>31.8 (9.4)</td>
<td>74.7 (8.2)</td>
</tr>
<tr>
<td>Other-model</td>
<td>38.9 (16.4)</td>
<td>32.2 (10.8)</td>
<td>61.6 (20.0)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Session 4</td>
<td></td>
</tr>
<tr>
<td>Self-model</td>
<td>61.6 (8.4)</td>
<td>30.2 (5.9)</td>
<td>80.7 (9.4)</td>
</tr>
<tr>
<td>Other-model</td>
<td>39.7 (12.7)</td>
<td>29.4 (10.1)</td>
<td>67.8 (10.6)</td>
</tr>
</tbody>
</table>

*Lower scores indicate less anxiety.

Figure 1 — Performance scores at baseline and across Experimental Sessions 3 and 4.
Effect sizes were calculated to examine the magnitude of change in swimming performance from Session 3 to Session 4. The effect size was quite large for the self-modeling group ($ES = 1.15$) and small for the other-modeling condition ($ES = 0.06$). Effect-size calculations for anxiety and self-efficacy from Session 3 to Session 4 produced small to moderate effect sizes. For anxiety, the self-modeling group ($ES = -0.21$) and other-modeling condition ($ES = -0.27$) showed small changes. For self-efficacy, the changes were moderate for both the self-modeling ($ES = 0.68$) and the other-modeling ($ES = 0.41$) conditions.

Considering the small number of participants in the study, which may have contributed to low statistical power, performance scores and self-efficacy scores were changed to $z$ scores for further comparison. Specifically, to examine the accuracy of self-efficacy beliefs as they related to performance, the performance and self-efficacy scores were changed to $z$ scores and performance was subtracted from self-efficacy. Positive $z$ scores would indicate overestimation of performance, and negative scores would indicate underestimation.$^1$

A 2 (modeling condition) × 2 (swim session) repeated-measures ANOVA was conducted to test for over- and underestimation of performance. Results indicated that there was no main effect between groups. However, there was a main effect between swimming sessions, $F(1, 8) = 23.61, p < .01$, which was superseded by the interaction of groups differences across sessions, $F(1, 8) = 16.25, p < .01$. As indicated in Figure 2, participants in both conditions demonstrated a congruent relationship between self-efficacy and performance during the second and third sessions. However, during the fourth session, participants in the other-modeling

![Figure 2](image-url)  
**Figure 2** — Accuracy of self-efficacy as it relates to actual performance at baseline and across Experimental Sessions 3 and 4.

$^1$This analysis was suggested by an anonymous reviewer.
condition demonstrated inflated beliefs about their abilities relative to actual swimming performance. Conversely, participants in the self-modeling condition continued to demonstrate a congruent relationship between swimming self-efficacy and performance.

In an attempt to understand why the performance differences between groups did not correspond to changes in self-efficacy and state anxiety, each individual’s scores were mapped across sessions for each dependent measure (See Figures 3 and 4). In the self-modeling condition, three participants (Participants 1, 5, and 9) showed the predicted increases in self-efficacy and performance, accompanied by a decrease in state anxiety. Two participants deviated slightly from this pattern: Participant 3 showed the predicted increase in performance and self-efficacy, yet state anxiety increased rather than decreased across sessions, and Participant 7 showed very minimal change on any dependent measure across sessions. The deviation in patterning of the results does not seem to be related to gender—only one of the two participants who deviated was male (Participant 3).

The patterning of participants’ responses in the other-modeling condition was less consistent. For all participants in this condition, self-efficacy increased relative to the second session, but this increase was not linear for all participants. Concomitantly, performance increased for 2 participants across all three sessions but decreased for 3 participants after the third session. Changes in anxiety were also inconsistent, as it increased for 3 participants and decreased for 2. The results for the participants in the other-modeling condition are interesting in that the inconsistent patterning of participants’ scores on dependent measures does not appear until after the third session. More specifically, the other-modeling condition was introduced during the third session, so it was not until the different modeling intervention was introduced that this variability of responses occurred. In fact, the dependent measures for this group show similar patterns to those of the self-modeling group between Sessions 2 and 3. But after the other-modeling condition is introduced, these results become very individualistic, as opposed to following a unified trend.

This individual patterning may explain the variability in the strength of relationships between dependent variables across sessions. For example, Pearson correlations were conducted among the dependent variables for each modeling condition across sessions. During the third swim session, anxiety was significantly correlated with performance ($r = .94, p < .05$) for participants in the self-modeling condition. However, this correlation was the opposite of what one might predict, with higher anxiety being related to better performance. There was no significant relationship between anxiety and performance for the other-modeling condition; however, anxiety sustained a significant negative relationship with self-efficacy ($r = -.94, p < .05$; see Table 3).

The dependent measures did not correlate with each other at any other point, but it is interesting to note the direction that these relationships took. For the self-model condition during the third session, anxiety was significantly related to performance, whereas self-efficacy was not. However, during the fourth swim session, the relationship between self-efficacy and performance got stronger ($r = .60$), whereas the relationship between anxiety and performance diminished ($r = .41$; see Tables 3 and 4). Conversely, for the other-modeling condition, Swim Session 3 showed a negative relationship between anxiety and performance ($r = -.47$) and a moderate relationship between self-efficacy and performance ($r = .48$). However, during the fourth swim session, the relationship between anxiety and performance
Figure 3 — Individual participant data for performance, self-efficacy, and anxiety for self-modeling.
Figure 4 — Individual participant data for performance, self-efficacy, and anxiety for other-modeling.
Table 3  Correlations Between Performance, Anxiety, and Self-Efficacy for the Third Swim Session

<table>
<thead>
<tr>
<th>Dependent measures</th>
<th>Performance</th>
<th>Anxiety</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.94*</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.16</td>
<td>-.17</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Self-modeling

| Performance | 1.00 | — | — |
| Anxiety     | -.47 | 1.00 | — |
| Self-efficacy | .48 | -.94* | 1.00 |

Other-modeling

| Performance | 1.00 | — | — |
| Anxiety     | .41  | 1.00 | — |
| Self-efficacy | .60 | -.32 | 1.00 |

*Significant at the .05 level.

Table 4  Correlations Between Performance, Anxiety, and Self-Efficacy for the Fourth Swim Session

<table>
<thead>
<tr>
<th>Dependent measures</th>
<th>Performance</th>
<th>Anxiety</th>
<th>Self-efficacy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>1.00</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.41</td>
<td>1.00</td>
<td>—</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.60</td>
<td>-.32</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Self-modeling

| Performance | 1.00 | — | — |
| Anxiety     | -.06 | 1.00 | — |
| Self-efficacy | .89 | .001 | 1.00 |

Other-modeling

| Performance | 1.00 | — | — |
| Anxiety     | .89  | .001 | 1.00 |

*Significant at the .05 level.

almost completely disappeared, whereas the correlation between performance and self-efficacy became much stronger ($r = .89$; see Tables 3 and 4).

**Discussion**

The present results are consistent with the current literature, which suggests that modeling is an effective means for producing behavioral changes (Bandura, 1986; McCullagh, 1993). Both the self-model and other-model group improved their swimming performance and swimming self-efficacy from baseline measures.
Although these changes cannot conclusively be attributed to modeling effects because there was not a no-modeling control group, it is worth noting that these behavioral changes did occur.

The operative question in this research, however, was not to provide further support for the claim that modeling is an effective teaching tool, but rather to understand how different types of modeling affect behavioral change. Specifically, how does self-modeling differ from observing other models? Interestingly, the only conclusive difference between participants who received self-modeling and participants who watched someone else was in swimming performance, with the self-model group showing significantly better swimming performance than the other-model group by the last swimming session.

These performance differences are consistent with the behavioral changes shown by previous research on self-modeling. Dowrick and Dove (1980) demonstrated that videotaped self-modeling is an effective tool to enhance swimming performance in children with spina bifida. The present results extend Dowrick and Dove's findings to a wider population. It also has the added benefit of comparing self-modeling to another form of modeling instead of simply showing that self-modeling can create a behavioral change.

Schunk and Hanson (1989) were among the early researchers to investigate how self-modeling works differently than other teaching mechanisms. They demonstrated that children exposed to self-modeling exhibit higher achievement than children in control conditions. The present study extends these findings by demonstrating that self-modeling is not just an effective technique for teaching new skills, but it may actually be more effective than other forms of modeling.

It is possible to argue that the performance differences between the self-model and other-model condition were created by differences in the information that participants received. However, every attempt was made to control for potential differences in information other than the model itself. The self-model group and the other-model group watched the same amount of videotape and the same number of skills prior to each swim session. Additionally, the edited versions of the other-model tape that the participants watched were matched to each person's swimming ability. Only skills that that participant could actually perform were edited onto the tape. Thus, participants were not watching skills that were either more or less advanced than what they were capable of doing in the water. Also, the other-model was not an expert swimmer; thus, her ability to perform the skills well was comparable to the edited versions of the self-model tape.

Given that differences in information were adequately controlled for, a logical assumption is that self-modeling may differ from other forms of modeling in terms of the psychological changes that it invokes. For example, watching yourself may have a unique impact on the learning process. We initially hypothesized that increases in self-efficacy and decreases in state anxiety would parallel any performance improvements. This hypothesis was consistent with social-cognitive theory, which states that human functioning is the product of reciprocal interactions between behavior, environmental variables, various cognitions, and personal factors (Schunk, 1989). However, there were no significant differences among modeling conditions across swimming sessions on either of these variables. This lack of significance could be attributed to several factors in the methodology. For example, it is possible that the first two sessions mitigated the anxiety and self-efficacy effects later in the experiment. Additionally, the effect of anxiety increasing in some participants as opposed to others could have been a function of arousal rather
than anxiety. It is also possible that the present study did not have enough participants to demonstrate differences in these cognitive processes. However, an alternative explanation for the fact that there were no differences among modeling conditions in either self-efficacy or anxiety is that the performance differences were due to some other variable that parallels the modeling process.

Despite the fact that there were no significant differences between groups on self-efficacy and anxiety, there were some interesting correlations between self-efficacy and performance. In the third swim session, when the different modeling conditions were introduced, self-efficacy did not correlate very highly with performance for the self-modeling groups but sustained a moderate correlation with performance with the other-modeling condition. During the fourth session, when performance for the self-modeling group got better, the correlation between self-efficacy and performance increased, but only to a moderate level. However, for the other-modeling condition, the correlation between performance and self-efficacy increased to a fairly high level, but their actual performance remained relatively unchanged. This indicates that for participants in both conditions, the relationship between self-efficacy and performance was increasing; however, the way participants used this information might have been different.

In fact, based on the analysis of z-score comparisons described in Figure 2, participants in the self-modeling condition seemed to maintain an accurate relationship between self-efficacy and performance, whereas participants in the other-modeling condition tended to overestimate their swimming abilities relative to their swimming performance. Perhaps, then, it is the accuracy of the self-efficacy belief as it relates to actual behavior that increases performance, and not the presence of increased self-efficacy alone.

It is interesting to speculate why the other-modeling condition might lead participants to overestimate their swimming abilities after observing a peer model, whereas the self-modeling group would maintain a more accurate representation. These discrepancies bring up the possibility that there were differences in self-regulatory processes between the two modeling conditions. Self-regulation, as defined by Schunk (1989), refers to “learning that occurs from students’ self-generated behaviors systematically oriented toward the attainment of their learning goals” (p. 83). Specifically, self-regulation comprises three interactive subprocesses: self-observation, self-judgment, and self-reaction. When people observe aspects of their behavior (either literally through videotape or by less direct means), they judge their own behavior against standards and may react either positively or negatively to that comparison (Schunk, 1989). Perhaps, in the present study, participants in the self-model group judged themselves against different standards than participants in the other-modeling condition.

Although no measures of self-regulation were taken, consider the following logic. Prior to the third and fourth swimming sessions, participants in the self-model condition saw edited tapes of themselves performing swimming skills to the best of their ability. Therefore, the standard by which they judged their own performance contained only positive feedback about their ability. Perhaps, then, self-modeling elicits a form of positive self-judgment that enhances a person’s ability to focus on the task at hand. In fact, this hypothesis is somewhat supported by an unsolicited comment made by one of the participants in the self-modeling condition:

After the initial shock of seeing yourself founder around, it helped. I paid attention and focused on what I needed to do... It helped to watch myself.
I really tried to remember what I was supposed to do, and look at what I was actually doing.

Conversely, the self-regulatory process that participants in the other-modeling condition engaged in as a result of watching the performance of a peer may have elicited a different form of self-judgment. Specifically, participants in the other modeling condition most likely engaged in some form of social comparison when forming self-judgments and self-reactions. Although this notion is just speculation, it is possible that the added presence of social comparison may enhance self-efficacy but may not elicit the same changes in self-regulation, which may be responsible for the increase in performance demonstrated by the self-modeling condition.

It is also possible that the performance differences were mediated by some other social-cognitive variables that were not specifically examined. For example, recent work in the education field (Schunk, 1990) postulates that motivation and attributions interact with learning strategies and goal-directed behavior, as well as learner characteristics. In fact, when one looks at the patterning of dependent scores for each individual participant, it is obvious that different people responded to the intervention in different ways. For example, one participant in the self-modeling condition did not show any change across sessions in performance, self-efficacy, or anxiety. However, this participant exhibited other signs of not being motivated to participate, such as consistently showing up late and rescheduling sessions. Thus, it is possible that motivation, or lack of motivation, was a more powerful moderator in terms of her performance. Also, when one looks at the variability of the patterning of the dependent measures among the other-modeling condition after the first viewing of the other-modeler, it becomes apparent that different participants had different reactions to the tape. Perhaps the other-modeler was more of a peer model for some than others, or based on initial levels of self-efficacy, perhaps some participants perceived her to be a much better (or worse) swimmer than they were themselves. Any of these attribution or motivational styles could have created the variability in the relationship among the dependent variables for each condition.

Despite the fact that there may have been differences in the self-regulatory, motivational, and attentional processes between modeling conditions, the reality of this experiment was that there was no difference between groups in either self-efficacy or state anxiety, which may be tied up in the self-regulatory process. It is possible that the present experiment did not have enough participants to provide a powerful enough design from which to test these relationships, but the small number of participants is counteracted by the number of swim sessions that each person participated in. The ecological validity of having participants participate in five different swim sessions, and re-editing videotapes between those sessions, is very strong. Therefore, it is probable that there is no differential effect of watching yourself perform a skill well versus watching someone else successfully perform that skill on either perceived self-efficacy or anxiety. Both types of modeling provide sources of information and motivation.

However, considering the present results, perhaps the most important finding from this study is that there were significant performance differences between participants in the self-modeling condition and participants in the other-modeling condition. Many other studies have shown self-modeling to be an effective means for creating behavioral change, but few, if any, have attempted to understand whether self-modeling works differently from other forms of modeling. In the future, it would be interesting to compare self-modeling with the use of other forms of
modeling not tested in this research, such as coping models, expert models, and participant modeling. Specifically, it would be important to identify how self-modeling affects the self-regulatory processes in relation to these other forms of modeling. It would also be helpful to use participants of varied skill levels—the present study only used beginners. Perhaps participants with more skill would respond differently to self-model or other-model tapes, because their frame of reference would be broader. Additionally, with a large amount of research demonstrating interactive effects between motivation and efficacy (Schunk, 1990), it would be interesting to look for a relationship between motivation orientation and/or attributions and the effectiveness of certain modeling conditions.

Methodologically, the present results seem to provide additional support to Dowrick’s (1991) recommendation that self-model tapes be updated to match the participant’s current skill level. Whenever this type of re-editing procedure is employed, the number of participants that can effectively be used is limited. However, as demonstrated by this research, the ecological validity of bringing participants back several times can be useful. In the future, if this type of experimental design is used again, it would probably also be useful to test the dependent variables (such as anxiety and self-efficacy) after each experimental manipulation, as well as prior to the experimental manipulation. This type of follow-up testing may help provide more insight as to how actual performance interacts with one’s judgments and later performance. It would also be useful to incorporate some form of structured interviews to tease out differences in the processing of the video information, such as the elements most attended to, motivation, attributions, and subsequent attentional focus.

References


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