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Learning to swim using video modelling and video feedback within a self-management program

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Although many adults who cannot swim are primarily interested in learning by direct coaching there are options that have a focus on self-directed learning. As an alternative a self-management program combined with video modelling, video feedback and high quality and affordable video technology was used to assess its effectiveness to assisting an adult to develop and practice swimming skills. The participant was a 36 year-old non-swimmer who had previously attempted unsuccessfully to learn to swim on previous occasions. A single subject design with baseline, intervention and 12-month post-intervention phase were conducted. Dependent variables included a continuous 25-metre swimming distance goal using the freestyle stroke. After a 13-week intervention phase the continuous swimming distance had increased to 25 metres. For this adult participant, self-managed learning proved to be an effective way to learn to swim and greatly improved her confidence around deep water.

Keywords: *self-management, video, modelling, feedback, swimming, adult*

Introduction

On average 290 people die of drowning in Australia each year, of which adults make up 85% of all the drownings (Royal Life Saving, 2011). However, this figure obscures the numerous unreported near-drowning cases where people were rescued (Australian Medical Association, 2010; Royal Life Saving, 2011). As the majority of the Australian population lives along the coastline, or have easy access to public pools, being able to swim has become an integral part of the Australian lifestyle. Adults who cannot swim not only run a very real risk of drowning but may also feel marginalised if they cannot participate fully in water activities. Learning to swim is a process that not only involves the shaping of a complex motor skill but also a significant amount of practice in order to become proficient (Ericsson, Krampe, & Tesch-Romer, 1993). Typically, an adult who cannot swim undertakes swimming lessons, however, the advent of the Internet, high quality portable video technology combined with programs that aid self-directed learning may provide viable alternatives to direct coaching. The potential for a person to learn how to swim when they cannot access a coach for reasons of cost or availability is of significance. While video feedback is currently used with elite athletes to improve performance little is know of its applicability to non-elite individuals wising to improve swimming skills. Accordingly, it was the aim of this study to examine whether a self-management program that included video modelling and video feedback components would facilitate swimming expertise.

A self-management program offers the novice swimmer a structure for self-directed learning (Watson & Tharp, 2014). The appeal of self-management is that it is inexpensive personally relevant, easily monitored, more likely to promote generalisation, maintenance and independence (Watson & Tharp, 2014). Self-management also has a lengthy history associated with behaviour change in the domains of sport (Polaha, Allen, & Studley, 2004; Wolko, Hrycaiko & Martin, 1993) and exercise (Flora, 2012; Kau & Fischer, 1974; Miller et al, 2008), although the application of self-management strategies to swimming has received little attention.

Video modelling has been a logical extension of the research demonstrating the clinical utility of live modelling procedures (Nelson, Gibson, & Cutting, 1973; Nikopoulos & Keenan, 2006; Rosenthal, 1977). There is also evidence to support the conclusion that symbolic modelling is as effective as live modelling (Bandura & Barab, 1973; Meharg & Woltersdorf, 1990). Typically, competent examples of the target behaviour are filmed and then watched by an individual who uses the video recording as a competent example to emulate. As a treatment procedure video modelling and video feedback have been used effectively in a variety of settings including anxiety reduction (Gagliano, 1988), nursing education, (Chang & Hirsch, 1994), self-care (Clark & Lester, 2000), language development (James, Wadnerker-Kamble, & Lam-Cassettari, 2013; Wadnerker, Pirinen, Haines-Bazrafshan, Rodgers, & James, 2010), clinical supervision (James, Collins, & Samoylova, 2013), the management of childhood conduct disorders (Brestan & Eyberg, 1998), and teaching children with autism to write (Moore, Anderson, Treccase, Furlonger, & Didden, 2103). Video modelling and video feedback has also been observed to be effective in the development of a range of physical activities and sporting skills (Boyer, Miltenberger, Batsche, & Fogel, 2009; Hager, et al, 2004). However, video modelling combined with video feedback is less well researched.

Recently, technology required for video modelling and video feedback has become easily accessible due largely to the proliferation of sophisticated mobile phones. The major advantage of 'Smartphones' is that they allow video modelling to be used without the need for specialised and expensive equipment (Hinck & Bergmann, 2013) and consequently are able to provide almost immediate feedback. The advantage of advanced iPhone technology is its high quality freeze frame that allows the capture of clear body images providing better opportunities for a swimmer to discriminate various elements of arm and leg positions as correct or incorrect. Previously, poor quality freeze frame technology limited the advantages of video feedback (Boyer, Miltenberger, Batsche, & Fogel, 2009). Video feedback, as distinct from video modelling, involves showing an individual a video of his or her own performance (Boyer, Milternberger, Batsche & Fogel, 2009). Video feedback further allows an individual to then analyse the digital recording using the predetermined set of behaviours that were selected

to define performance with the intention that he or she will use it as a benchmark to reflect on the difference between his/her performance and that of the model in order to change their behaviour to more closely match that of the model (James, Collins, & Samoylova, 2013).

The majority of behavioural interventions in sports and exercise have been aimed at improving an existing skill, increasing or decreasing behaviours already in the individual's behavioural repertoire (Hume & Crossman, 1992; Wolko, Hrycaiko, & Martin, 1993). Only a handful of studies have examined the acquisition of new sport skills such as teaching golf swings to beginners (Johnston-O'Connor & Kirschenbaum, 1986) and service techniques to novice tennis players (Buzas & Ayllon, 1981), while fewer still have focused on self-management and swimming. Those that did tended to concentrate on self-management techniques to further improve the swimming skills of children (Koop & Martin, 1983) and adults (Polaha, Allen, & Studley, 2004) who were already competent swimmers.

Therefore, the present study examined the effects of a self-management program in teaching an adult non-swimmer to swim. In what follows, self-management is defined and four pertinent topics related to self-management are reviewed: goal setting, self-monitoring, feedback and self-evaluation. While there is no widely accepted definition of self-management, for the purposes of the present study self-management is defined as the ability of an individual to monitor his/her own behaviour and then to effect the necessary cognitive, behavioural and emotional responses required for self regulation (Barlow, Wright, Sheasby, Turner, & Hainsworth, 2002; Watson & Tharp, 2014). In other words, self-management is the ability of an individual to systematically alter his or her own behaviour. In what follows goal setting, self-monitoring, feedback and self-evaluation are reviewed as they form key components of self-management.

Previous research has demonstrated that goals should be specific rather than vague (Boyce, 1990), challenging but achievable, and should include proximal as well as distal objectives (Locke & Latham, 2002). Latham and Locke (2007) suggested that an achievable goal is one that no more than 10% of individuals could reach without the use of goal setting or other interventions. Goal setting research has suggested

that in sport and exercise moderate goals are superior to difficult ones (Kyllo & Landers, 1995). The principles of goal setting derived from organisational management appear to generalise well to sport and exercise, improving sporting and exercise performance by .34 of a standard deviation against 'no goals' or 'do your best' control groups (Boyce, Wayda, Johnston, Bunker, & Eliot, 2001; Kyllo & Landers, 1995). This finding has been verified from studies of the value of self-set goals in the sports of rugby, boxing and football (Mellalieu, Hanton, & O'Brien, 2006; O'Brien, Mellalieu, & Hanton, 2009; Ward & Carnes, 2002). Significantly, higher levels of commitment are observed in those individuals who are themselves involved in the process of goal setting. Kyllo and Landers (1995), for example, reported large effect sizes for individuals who set their own goals (.62) or were allowed to participate in the goal setting process (.49) compared to groups who were assigned goals (.30).

Self-monitoring has often been used in the context of improving sporting performance by using time on task measures during practice drills. Monitoring further involves documenting the frequency, duration or intensity of a behaviour, often using a diary, logbook or cumulative graph. Such techniques have proved to be advantageous to figure skaters (Hume, Martin, Gonzalez, Cracklen, & Genthon, 1985) gymnasts (Wolko, Hrycaiko, & Martin, 1993; Boyer, Miltenberger, Batsche, & Fogel, 2009) and swimmers (Polaha, Allen, & Studley, 2004). McKenzie and Rushall (1974) conducted one of the first research studies using self-monitoring in a sports context. The problematic behaviour was poor attendance and rate of practice by a youth swim team. The use of waterproof display boards positioned at one end of a pool, on which swimmers could indicate their attendance at practice and mark off work units as they completed them, significantly improved attendance and, in turn, swimming rates. However, the possible confounding effect of the coach's verbal feedback was not controlled for in the study. In 1991 Critchfield and Vargas replicated McKenzie and Rushall's study, this time controlling for the influence of the coach, and found that swimming rates increased, with swimmers maintaining higher swimming rates in the 'self-monitored condition' compared with the 'instructions-only condition'.

More recently, Polaha, Allen, and Studley (2004) also investigated

whether self-monitoring could enhance skill development. The study examined whether self-monitoring could reduce the swimming stroke, a measure of increased stroke efficiency. Results indicated that swimmers were able to reduce their stroke counts during periods of self-monitoring. However, stroke counts returned to baseline when self-monitoring ended suggesting that to maintain target behaviours self-monitoring needed to be maintained (Watson & Tharp, 2014). Interestingly, it would appear that accuracy of self-monitoring is not necessary to achieve improvements in the behaviour being monitored, possibly change is a function of the act of observation itself (Marshall, Lloyd, & Hallahan, 1993).

Feedback has traditionally been viewed as a necessary part of learning and performance (Ericsson, Krampe, & Tesch-Romer, 1993; Kazdin, 1993; Spiegler & Guevremont, 2010) though there is debate over how much feedback is required (Lee, Keh, & Magill, 1993) and whether feedback should be positive, negative or corrective (Brophy & Good, 1986), it is agreed that some is better than none (Lee, Keh, & Magill, 1993; Patrick, 1992). Behavioural coaching using feedback, instructions and reinforcement has been effectively used to improve practice behaviours of young female competition figure skaters (Hume, Martin, Gonzalez, Cracklen, & Genthon, 1985), technique of youth tennis players (Buzas & Allyon, 1981) and stroke performance of youth swimmers (Koop & Martin, 1983). Studies appear to support feedback from technology being superior to regular coaching methods. For example, video modelling has been used with gymnasts and swimmers where a video of an expert performing the technique is shown followed by viewing a video of the athletes themselves performing the same technique (Boyer, Miltenberger, Tactche, & Fogel, 2009; Hazen, Johnston, Martin, & Srikameswaran, 1990). This method of feedback was found to be successful in improving the skills of swimmers and gymnasts more quickly than regular practice and coaching alone.

Inherent in the process of self-management is the comparison made between current performance and set goals. This involves an evaluation about whether behaviour change is occurring in the desired direction (Miltenberger, 2012). Termed self-evaluation, this use of feedback allows the individual to correct or maintain his or her behaviour and is seen to be essential in skill development (Ericsson, Krampe, &

Tesch-Romer, 1993; Miltenberger, 2012). The evaluation data collected through observations allows decisions to be made about the individual's self-management plan, often by examining a graph (Watson & Tharp, 2014).

The present study was designed to examine the effects of a self-management program that incorporated goal setting, self-monitoring, feedback and self-evaluation, together with video modelling and video feedback on the swimming skills of a 36 year-old non-swimming female. It was anticipated that swimming ability would improve to the point that the participant was swimming 25 metres unaided and without stopping and that these improvements would be maintained for at least 12 months.

Method

Participant

The participant was a 36 year-old female in good physical health. A physician's approval form was obtained prior to beginning the study, and a detailed medical history was taken showing that her past medical history was unremarkable. The participant had previously undertaken swimming lessons but swimming competency was not achieved. She was unable to exhale under the water or to put her face in the water for any length of time. She was also unable to float. She feared deep water and as a result her behaviour prior to the commencement of the study had been to avoid settings where the bottom of the pool or the beach could not be touched easily with both feet. However the participant was motivated to learn to swim in order to be able to enjoy swimming with her young son and provide assistance should he encounter difficulties in deep water. Consequently, she had committed to facing and managing her anxieties in order to undertake the swimming program. Prior to and during the study the participant attended gym sessions for 60 minutes three days a week during which time she completed 10 minutes on the treadmill, 10 minutes rowing, and 30 minutes of resistance and weight training followed by a 10 minute stretching and cool down period.

Materials and setting

Standard female swimming bathers, a standard size polyethylene

kickboard (35cm x 26cm), iPhone with a video-recording feature, chalk and a measuring tape were used at various stages of intervention. Three YouTube video clips that included a person modelling arm rotation and freestyle swimming were used for video modelling purposes (iSport, 2012; Triathlon, 2009). Practice sessions were conducted at a 25 metre indoor swimming pool ranging in depth from 1.50 to 2.00 metres.

Design

A changing criterion design with changes in the direction of reduced support and increased behavioural demand was used within the structure of a single-case experimental design. A single-case design was used as this design has the ability to demonstrate experimental control with a single participant. Single-case designs provide rigorous experimental control, more so than case histories because, while case histories are based on correlations among events, single-case designs systematically introduce and withdraw independent variables to study effects on behaviour (Kennedy, 2005). Single-case designs are well suited to initial pilot testing because important functional relationships between an intervention and the problem can be identified using far fewer subjects. Indeed, several replicated single-case experiments can potentially establish a promising avenue for treatment then providing justification for larger and more expensive randomised control studies (Barlow, Nock, & Hersen, 2009). In addition, there is some evidence that single-subject designs are well suited to assessing the effects of an intervention designed to improve athletic skills (Martin, Thompson, & Regehr, 2004). Repeated measurements were obtained in order to establish stable baseline measures prior to intervention. The effectiveness of the treatment/intervention phase was determined by whether the participant's behaviour changed to meet the performance criteria of swimming 25 metres using three successive approximations of the freestyle stroke (i.e., flotation assistance with kicking only, flotation assistance with kicking and arm strokes and finally kicking with arm strokes and without flotation assistance). Repeated measurements of the dependent variable were collected during all phases. Following the completion of three successful trials within one session the criterion was changed.

Video modelling and video feedback

Several types of video modelling were considered for use in the present study. The types were; basic video modelling, video self-modelling, point-of-view video modelling, and video prompting. Basic modelling involves a participant watching a pre-recorded video of a person modelling the targeted skill. Video self-modelling records the participant's own behaviour displaying the targeted skill that is then viewed at a later time and requires subsequent editing to produce an optimal performance of a behaviour the participant cannot currently perform. Point-of-view video modelling shows a video recorded from the perspective of the participant while video prompting is used when teaching a step-by-step skill. It is recorded by breaking the targeted skill into steps and pausing after steps to give a participant an opportunity to perform each step before viewing the next. Basic video modelling was selected for use in the present study as adult models demonstrating correct swimming strokes were freely available on YouTube and did not require any technical photographic knowledge required for self-production of swimming videos. Video feedback was also used as it can maximise skill learning by focusing on a specific feature such as arm rotation. Video feedback also allows immediate feedback and reinforcement.

Procedure

Recording of dependent variable measures was undertaken at practice sessions twice a week in the late afternoon. At poolside, before the swimming trials began, the participant viewed the YouTube video model of a competent freestyle swimmer. Swimming sessions of approximately 20 minutes each (3 trials) were undertaken twice a week on non-consecutive days. One session per week was for practice only during which time only the participant was involved. During both 'practice only' and 'recording sessions' the participant attempted to swim from one end of the pool for as far as she could without stopping. The participant was deemed to have completed a lap when her hands touched the end of the pool. As the lane dividers indicated every metre by a change of colour, the participant could measure the distance covered by counting the colour changes.

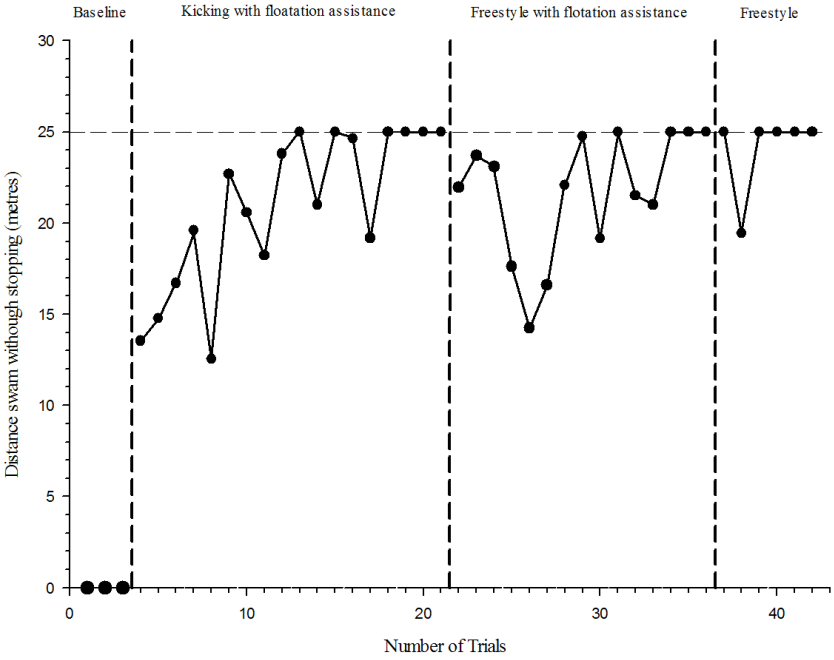
In the recording session a confederate recorded swimming distance by

walking approximately one metre behind the swimmer using the iPhone video recording feature. During the recording session if the participant paused before reaching the end the confederate placed a chalk mark near the edge of the pool to record the distance completed before stopping. Measuring from the chalk mark to the nearest pool divider allowed an accurate assessment of the distance. The swimming trials that were recorded on the iPhone were played back to the participant for the purposes of video feedback at the conclusion of each trial. The video recordings allowed the participant to evaluate her swimming style, compare it with the model on the YouTube video and to correct her stroke. The confederate was only involved in recording the participant's swimming and distance and played no role in the experimental design, coaching, planning or feedback. This decision was made to avoid confounds resulting from coaching or feedback other than that provided by the YouTube video and iPhone recordings. After 12 months the participant was contacted to establish whether she had maintained her ability to swim 25 metres and if swimming had become a regular activity.

Results

Figure 1 depicts individual data for swimming progress across 4 phases. Baseline remained at zero for the three trials clearly demonstrating that the participant was a non-swimmer. In the following 'kicking with flotation assistance' phase the distance increased from 13 to 25 metres, meeting the criterion after 18 trials. In the following phase, 'freestyle with flotation assistance', the participant met the criterion after 15 trials with the final goal of swimming 25 metres freestyle met in six trials.

Figure 1. *Swimming distance over time across four experimental conditions*



An interview with the participant after a year confirmed that the participant maintained her ability to swim 25 metres without stopping for at least 12 months.

Discussion

This study was designed to assess if self-directed learning could be a viable alternative to direct coaching in the context of learning how to swim. Although the results are consistent with previous research suggesting that self-management techniques may be an effective means of acquiring new behaviour we are not arguing that a self-managed swimming program is superior to direct coaching, rather it is presented as a viable learning alternative available for the non-elite swimmer. In situations where individuals cannot easily access or afford tuition, self-management using both video modelling and video feedback may be a way by which non-swimmers can achieve their learning-

to-swim goals. The self-management package, through a process of successive approximations, facilitated progress from non-swimming to swimming 25 metres. This outcome was especially important given the participant's previous lack of success in learning to swim. There is no consensus regarding the time it takes for a non-swimmer to progress to being a confident swimmer as it is linked to factors such as the quality and number of structured lessons, how often they practice, and their individual ability and self-efficacy. The participant in the present study became a swimmer in a little over 8 and-a-half hours distributed across a 13 week intervention period. Interestingly, her previous self-reported fear of deep water did not adversely affect her self-managed swimming program. Had anxiety played a greater role then her progress may have suffered. Future researchers would be well advised to establish levels of anxiety prior to beginning a swimming program as there is anecdotal evidence that individuals learn to swim quite quickly once water anxieties have been conquered. As importantly, there is a need to replicate this study to examine if swimming mastery can be facilitated by self-management with other non-swimmers.

While the participant in the present study was motivated to begin a self-managed swimming program her motivation and attitude towards swimming was not measured and addressing this issue might strengthen future studies. Following studies also need to take into account the heightened sense of personal responsibility to engage with the task when an individual undertakes a task on their own rather than in a group. Participation in a group can result in a diffusion of responsibility and, in turn, a reduced sense of responsibility for success (Ciccarelli & White, 2009), suggesting that practicing alone may have provided some form of an advantage over group lessons. Competition within a group might also increase both motivation and performance. Furthermore, the limitations of single-case research design include restricted generalisability of the present study's conclusions. While not a limitation per se, the necessity of some form of supervision during practice sessions needs to be emphasised as the risk of a non-swimmer becoming distressed while in the early stages of learning to swim remains a possibility. Limitations aside, the self-managed training program described in the present study proved to be both feasible and effective in changing the behaviour of a non-swimmer as the participant learned how to swim and as importantly maintained this ability over a 12-month period.

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