Human Movement Science 41 (2015) 9–19

Contents lists available at ScienceDirect

Human Movement Science

journal homepage: www.elsevier.com/locate/humov

Self-control behaviors during the learning of a cascade juggling task

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ARTICLE INFO

PsycINFO classification:
2330

Keywords:
Self control
Self regulation
Feedback
Perceptual motor learning
Knowledge of results
Motor processes

ABSTRACT

This study examined the self-control behaviors of participants learning a 3-ball cascade juggle. Participants chose when they would receive one of four types of instructional assistance: (a) instructions; (b) video demonstration; (c) knowledge of performance (KP); and (d) knowledge of results (KR). Juggling proficiency was divided into three categories based on catches per attempt during retention and transfer testing. In general, participants decreased their requests for instructions and video demonstration throughout acquisition. For the most proficient performers, requests for KR *increased* over practice. Post-experimental interviews revealed that participants requested KR after primarily good attempts and KP after both good and bad attempts. Participant-reported reasons for requesting feedback included the confirmation of success (KR) and identification of technique flaws (KP). Overall, the findings suggest that self-control behaviors are more complex than previously demonstrated and that participants use self-control differently depending upon the type of assistance available, individual preferences, and learning needs.

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http://dx.doi.org/10.1016/j.humov.2015.02.002
0167-9457/

1. Introduction

Previous motor learning research has established a learning benefit for allowing participants to choose if and when they receive selected types of instructional assistance (see Wulf, 2007, for a review). The benefits of providing participants with such *self-control* over an aspect of the instructional protocol have been demonstrated for several different modes of instructional assistance (e.g., feedback, Chiviacowsky & Wulf, 2002; physical guidance, Wulf & Toole, 1999; and video demonstration, Wulf, Raupach, & Pfeiffer, 2005). Despite growing interest in self-control effects on motor learning, the majority of studies have focused exclusively on an either/or choice about the administration of a single mode of assistance. For example, a participant in a self-control condition might be allowed to choose between receiving feedback or not receiving it after a given trial. In real-world settings, however, learners often have a far greater range of autonomy. A novice learning a basketball set shot could presumably ask for instructions, demonstrations, or feedback about various aspects of an attempt (e.g., set-up, follow-through, or ball trajectory). Existing self-control literature thus provides an incomplete picture of how learners make choices when allowed to manage the more complex informational landscapes seen in real-world practice settings. The purpose of this study, therefore, was to examine the choices that learners make when afforded the autonomy to *self-control* several different modes of instructional assistance while learning a novel motor skill.

Current understanding of how self-control effects operate is quite limited. This is due in part to the vagueness of purported explanations (Chiviacowsky & Wulf, 2002) and the lack of direct tests of possible mechanisms. The potential candidates forwarded to explain self-control effects include deeper information processing, increased confidence and motivation, and the development of more effective learning strategies (Janelle, Barba, Frehlich, Tennant, & Cauraugh, 1997; Janelle, Kim, & Singer, 1995) and the freedom to tailor the practice setting to meet learning preferences and needs (Chiviacowsky & Wulf, 2002). Additionally, the benefit of self-control provisions has been tied to self-evaluation processes based on reports that learners prefer feedback following so-called "good" trials compared to "poor" trials (Chiviacowsky & Wulf, 2007). Such preferences may have been influenced by the simplicity of the task and feedback or by the dichotomous nature of the questions used. Subsequent research using a more complex task and feedback with more information (a basketball set shot with video knowledge of performance [KP]) found no preferences (Aiken, Fairbrother, & Post, 2012). Self-control participants reported requesting feedback at about the same frequency following both good and poor trials. Moreover, responses to open-ended questions indicated that participants were interested in using feedback for both error correction and confirmation after successful trials. The Aiken et al. study suggested a more complex picture of how self-control participants manage task-relevant information than previous research has presented. Although participants presumably used the video KP to focus on multiple aspects of their shooting form (i.e., some "good" and some "poor"), the study was not designed to show how the feedback requests were used to manage the information relevant to these aspects.

One barrier to a clearer understanding of self-control effects on learning is the relative lack of information about how participants behave when placed in a self-control protocol. There is a need for descriptive research designs aimed at documenting request behaviors of self-control participants and establishing logical connections between these behaviors and motor skill performance during practice and testing. Such research can reveal the subtle ways in which individual participants respond to the challenge of managing instructional assistance when learning a new motor skill and can thereby serve as an intermediate step in determining the focus of future experimental research. Some researchers have additionally suggested that a social-cognitive approach using more ecologically valid and complex tasks might be potentially fruitful for examining self-control behaviors (Lewthwaite & Wulf, 2010; Wulf & Shea, 2002). Interestingly, the early self-control research in motor learning (Janelle et al., 1997) was grounded in a social cognitive framework, which relied heavily on ideas about self-regulation that had emerged from studies on student behavior in relatively unconstrained learning environments (e.g., Zimmerman, 1989). Janelle et al. (1997) reasoned that the degree to which a learner *effectively* self-regulates with respect to a learning goal might influence a learning outcome. Although the results reported by Janelle et al. were consistent with notions about the enhanced effectiveness of self-regulated learning, subsequent studies have largely been characterized by constrained settings where learners are