Factors affecting learning and retention: A unified list

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Abstract

This note provides a diagrammatic representation of factors affecting learning and retention. Through its structure it starts to provide a theory of learning and retention, noting the important aspects of the learner, their previous knowledge, the task being learned, how it is learned, and what influences retention. It is not complete, but pulls together a wide range of factors influencing learning and shows that learning and retention can be seen as a complex area.

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Introduction

It would be useful to have a graphical and structural representation of what factors influence learning and retention. This graphical representation could be used to summarize a review of learning, and could be useful in teaching.

Figure 1 provides a structured representation of factors influencing learning and retention. These are based on recent readings and work in the Applied Cognitive Science Lab, including recent publications on fidelity (Ritter & McDermott, 2020), learning and tutoring (Friedrich & Ritter, 2020; Garrison, Ritter, Bauchwitz, Niehaus, & Weyhrauch, 2021; Garrison, Ritter, Weyhrauch, Niehaus, & Bauchwitz, 2019; Ritter, Qin, MacDougall, & Chae, in press; Ritter, Yeh, Yan, Siu, & Oleynikov, 2020; Tehranchi, Oury, & Ritter, 2021), HCI (Oury & Ritter, 2021; Ritter, 2019; Ritter, Baxter, & Churchill, 2014), and cognitive modeling (Middleton, Weyhrauch, Lynn, Ritter, & Dancy, 2018; Ritter, Tehranchi, & Oury, 2019).



Types of Factors Influencing Learning and Retention

Figure 1. Factors influence learning and retention.

The factors can be grouped into several groups related to the order of a process model of the components of learning, the time spent between learning and test, and then time at test.

Perhaps the first group that should be examined is what is being measured. Initially, one might want to examine response time, particularly its mean. Some have argued for including the distribution and also the range and outliers. There can be situations where all of these measures are important. Learning might be measured by errors and the types of errors. There are tasks where error types and rate are important and they are often theoretically important. Errors are harder to study, though, because often large amounts of correct behavior have to be generated to gather the errors. The type of knowledge learned can also be examined. The procedural and perceptual-motor knowledge can be measured by performance time. But, other types of knowledge are often learned and make a task. Recognition of objects or situations, and the ability to recall and verbalize can be important aspects of learning even if they are not often recorded or studied—they are often used in the field and used to teach the knowledge. In areas where see one, do one, teach one are important, such knowledge is crucial.

The second group of factors is aspects of the learner. These include cognitive capabilities, for example, working memory capacity; previous knowledge, which can influence what can be learned and how well it will be retained; their physiology, which is used to represent the effect of sleep and other aspects that can affect performance and learning; and finally, motivation and emotional aspects.

The third group is the task. This set of features notes that learning can be task specific. The interface that learners use to do the task can influence the amount of practice (Ritter & McDermott, 2020; Ritter, Yeh, McDermott, & Weyhrauch, submitted, October 2021). The task being learned and its relation to previous knowledge can also influence the amount of transfer (Thorndike & Woodworth, 1901). It is perhaps the case that studies on learning and retention on

one task will overgeneralize to what seem like similar tasks, but which are not.

The fourth group is the training system and schedule. The time on task, the interface to the task, as well as the types and timing of tasks influence learning. Instructional strategy is another way the training schedule can be viewed.

The fifth group is the decay period. The amount of time and what happens in that time can influence retention. For example, submariners note that they can come back to a conversation with a neighbor ready to pick up where they left off months previously after a patrol. The neighbor has had other memories and interactions in that same spot and cannot retrieve as much. Thus, the environment broadly defined can influence retention.

The sixth group is variables related to the test. How important the test is, how many warm up trials, and the interface and details of the task will influence how much appears to be retained.

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