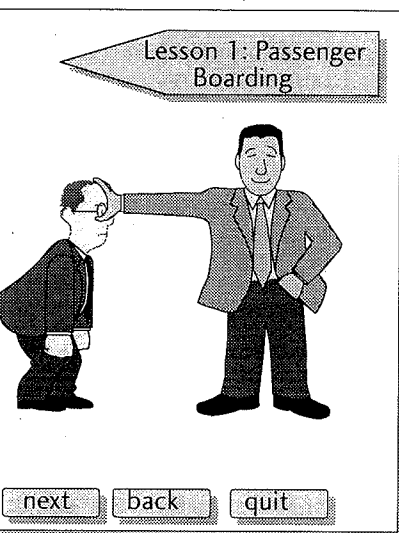


## Practice Exercises

plan practice exercises to build mental models. The goal include the type of practice to be used, the nature of feedback, and the nature of the practice.

## Practice Exercises

Practice exercises stimulate elaborative rehearsal rather than rote repetition. For example, the screens in Figures 8.2 and 8.3 show teaching airline gate agents reasons for denying boarding. The interaction in Figure 8.2 promotes elaborative rehearsal of information already presented. It requires the learner to repeat the content of the information by the learner. In contrast, the interaction in Figure 8.3 presents new information to a work-related scenario. When the learner clicks on a passenger, a brief dialog box appears. For example, one passenger says, "How many? Well...maybe 15." The learner can drag each passenger onto the concourse or deny boarding. A nice application of a drag-and-drop interface is presented in a multiple choice or dichotomous choice question. It's not the format of the question or the process that the question stimulates.



There are many reasons American may refuse to transport passengers. Each passenger shown below has a unique situation that may require you to refuse them. When you select each one, they will explain their situation. If you want to deny them transport, drag them to the concourse. Otherwise drag them to the aircraft.

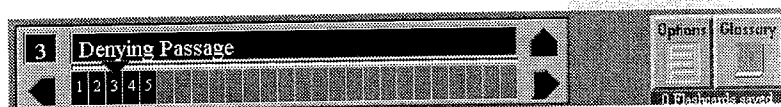
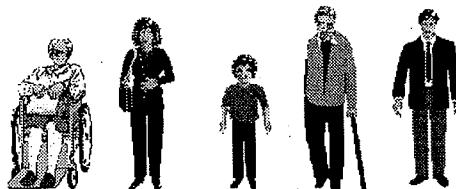


Figure 8.3 Elaborative rehearsal practice.

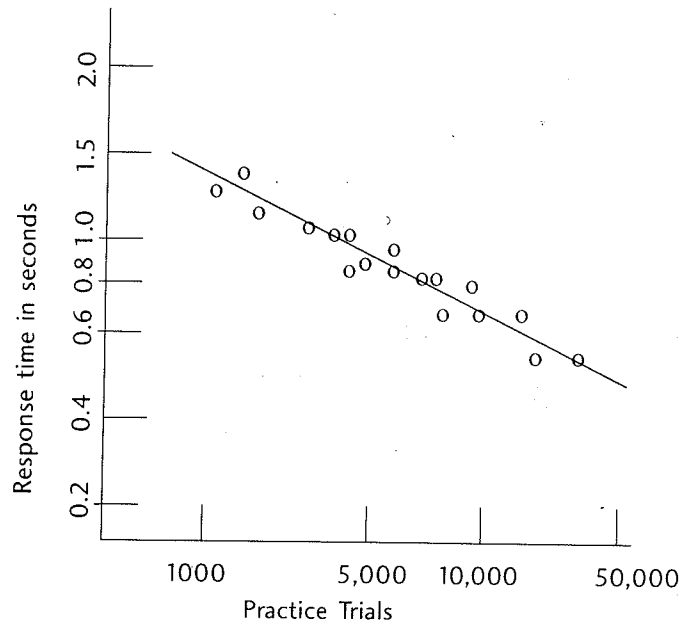
## Research on Elaborative Practice

Learners were assigned one of four types of essays to write while researching a historical event from a textbook or from Internet sites. The essay types were (1) a summary of the readings, (2) a narrative of what happened, (3) an explanation of what happened, or (4) an argument that discussed two opposing interpretations of the events. The researchers measured the quality of the essays produced. They also measured far-transfer learning using a test that required application of the concepts to new historical situations. They found that the argument assignment—especially when learners had to draw information from Internet sites, resulted in more complex essays and in better scores on the final test (Wiley and Voss, 1999). The mental work of synthesizing diverse sources into a pro-and-con discussion fostered the greatest amount of elaboration and subsequently the deepest learning.

## How Much Practice Is Enough?

While practice may never make perfect, it does improve performance indefinitely, although at diminishing levels. Timed measurements of workers using a machine to roll cigars found that even after four years of practice that involved thousands of trials, proficiency continued to improve (Crossman, 1959). A graph of time to complete a task plotted against the number of practice trials (See Figure 8.4) shows a logarithmic

relationship. This *power law* of practice applies not only to motor skills like the cigar-rolling machine but also to intellectual skills such as writing (Rosenbaum *et al.*, 2001).



**Figure 8.4** Speed increases at a logarithmic rate with more practice. (Crossman, 1959.)

This is why world-class performers like Tiger Woods continue to practice. One of the most important findings about expertise is that performance proficiency is strongly related to the time and efficiency of deliberate practice. The more one practices, the better one gets, regardless of initial talent and ability. In fact, in the absence of practice, the more talented individuals lose their edge compared to the less talented individuals who continue a regimen of deliberate practice (Ericsson, 1990).

Learning from e-learning lessons with higher and lower numbers of practice exercises showed that both better and poorer learners (as defined by grade-point average) improved their test scores in course versions with more practice. However, as you can see in Figure 8.5, the amount of improvement was not in direct proportion to the amount of extra time invested to complete the practice. In fact, poorer learners invested 75% more time for a 14% gain in scores (Schnackenberg *et al.*, 1998). As you consider how much practice to include in your training, weigh the cost-tradeoffs of the extra time learners will need to complete practice. For critical tasks such those with safety consequences, high amounts of prac-