Readers and instructions

1. Overview

User instructions are produced to accompany products and explain how to execute a task.

This summary of research focuses on the difficulties of using instructions for procedural tasks, how people use instructions, and how to support people with the information they need to execute procedures successfully.

Research has shown that people make mistakes and that complicated instructions increase cognitive load.

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2. What we know

1 Processing instructions is a complex cognitive activity

When people follow instructions, they engage in a range of processing activities (Ganier, 2004). This includes getting an overview of the task (e.g. as shown through headings); balancing what they already know with new information found in the instructions; and keeping track of whether what they do has anticipated results. They need to crosscheck between the instructions and the device.

2 People make mistakes

Common user errors with self-test kits include errors in positioning the sampling devices for the test, carrying out the steps in the right order, following the test times correctly, errors in interpreting the results, and users failing to refer to the instructions altogether. Other common errors may occur in transferring a set volume of sample to a test and collecting insufficient sample volume (Peck et al., 2014; Seidahmed et al., 2008; Smith et al., 2016; Weinhold et al., 2018).

3 People read instructions in different ways

Research has shown that instructions are rarely read cover to cover before starting the procedure (Eiriksdottir et al., 2011; Wright, 1999). Further, people make assumptions about what they know and approach instructions with their own questions, which means they use a range of strategies. Ganier (2004) proposed that novice readers are more cautious and have an instructions-based approach (they tend to read instructions linearly and before starting the procedure), while expert readers adopt a more 'interactive' approach (reading while executing the task) and returning readers may only turn to instructions to find answers to specific questions.

4 Prior knowledge is decisive in how people deal with instructions

People with some familiarity with the topic may be able to close gaps in the instructions thanks to their contextual knowledge, but words and images can become barriers to learning if they are unfamiliar or difficult to interpret by novice readers. For example, prior knowledge provides the ability to discriminate between essential and non-essential information, so novice readers may be unable to select the most important elements in an image if there is no signalling to guide their attention (de Koning et al., 2009; Schriver, 1997; Van der Meij et al., 2004).

5 Instructions contain different kinds of information

Effective instructions clearly set out all the elements that will be needed (inventory information), the actions to be done (operational information), information about the relative positioning of the parts and the general outcome of the procedure (Bieger et al., 1984/85). Further, supportive information and information to detect and correct common problems supports people by providing context that aids decision-making (Van der Meij et al., 2004).

6 Separating the different kinds of information is helpful

People follow instructions more accurately when they are given a high-level description of the task at the beginning (Dixon, 1982), so providing a clear goal and (if relevant) an image of the final outcome can help readers to represent the outcome of the task (Burnham, 1992). Further, warnings and supportive information should appear close to, but separate from their relative action step (Burnham, 1992). By providing the information close to the action step, we make sure that the information is active in working memory so that it can influence action. Equally, provide prerequisites at the beginning, separate from the action steps (Kester et al., 2001; Van Merriënboer et al., 2003).

7 Stress impedes cognitive capacity

The interaction between emotions and cognition is not yet fully understood. However, research on working memory has shown that anxiety makes it harder for people to concentrate when they are feeling anxious or nervous. Anxiety impairs cognition differently depending on the type and difficulty of the task. For example, tasks that require verbal working memory are disrupted only when the difficulty is low and medium. But for tasks that require visuo-spatial working memory (to do with images), anxiety reduces cognitive performance irrespective of the difficulty of the task (Vytal et al., 2012; Vytal et al., 2013).

8 Breaking down procedures into discrete steps is helpful

When the structure of instructions resembles the structure of the events they describe, it is easier for people to map what they see in the instructions to what they see in the world (Tversky et al., 2002). Therefore, it is advisable to break the action into concrete steps, considering key objects and the most important actions on objects (Tversky et al., 2008). Further, people can hold a limited amount of information in their working memory at any time (Baddeley, 1992). Breaking up the process into steps, and grouping steps meaningfully can reduce cognitive load and may make it easier for people to remember the information (Miller, 1956).

9 Detail in the action steps is helpful	In cases where the instruction is done once, occasional users are not expected to incorporate the procedure into long-term memory or acquire skills, so the primary aim is to support people in executing the task correctly. In each action step, enough detail must be provided so that people can understand and apply the information (Eiriksdottir et al., 2011). Generic procedures may be more familiar to readers and may require less detail. However, tasks that are specific to the device or procedure may require more detail. Condition information is remembered in relation to actions, so actions to be performed should be presented first, and modal information should come after the action (Dixon, 1982).

3. Recommendations

- Tell readers to read the instructions as a whole before starting the test, but design for readers who won't.
- Start with an inventory of elements that will be needed to carry out the task.
- Clearly set the goal of the procedure at the beginning.
- Write in a step-by-step manner, focusing on actions around objects.
- Write each directive to match the order of the actions ('*First do this… Then do this*').
- If an instruction has too many steps, divide it into into steps, and set a clear subgoal for each step.
- Include warnings, caveats, prerequisite information and information on common problems and how to solve them. Separate these from the action steps, but keep them together so that they appear when the reader needs them.

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