STEPS FOR ACHIEVING GOOD USABILITY

While developing a new data system, attention often focuses on *what* the system will feature rather than *who* will be using the system. Knowing what data the system holds is important. However, planning teams also need to carefully consider the needs of the users and the types of tasks they need to perform. Identifying and addressing usability issues early on can benefit the project, the organization, and ultimately, the end users. This document describes how planning teams can support usability by considering user and task needs and aligning these needs to the data system design.
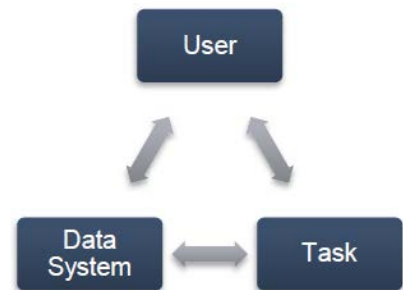
What is Usability?

Usability refers to how easily users can perform a *task* efficiently and accurately using a system. A *system* can support usability through design features that help the *user* to perform tasks quickly and without errors. Examples of such design features include a logical system workflow, consistent human-computer interactions, and simple user interfaces that follow best practices. Developing a system that supports usability requires a planning team to have a deep understanding of users, their expectations, and the tasks that they need to perform.

What is Usability Testing?

Planning teams conduct usability tests to find out how well a system enables users to perform tasks efficiently and accurately. Testing helps find where users have problems and experience frustration and also highlight where the design works well and delights users. Test results guide the team to refine the design and improve usability during the system development process—not after deployment.Why Conduct Usability Testing?

When usability issues are addressed during the design process, organizations can avoid making late fixes that can be costly and time consuming. When systems are easy to use and easy to learn, organizations spend less time and money on training and making system fixes. Users can work efficiently and be more satisfied.

FACT:

A project can cost up to 100 times more if usability issues are addressed after deployment than if the issues had been identified and addressed early in the design process.

Source: EUROCONTROL. (1999). *Human Factors Module. A business case for human factors investment.* (HUM.ET1.ST13.4000-REP-02). Brussels: Author.

When Should Usability Testing Occur?

Usability testing should occur several times from the start of the design process through to system maturity. Each test will help the planning team to identify usability issues and provide an opportunity to refine the design before launch.

DESIGNING A USABLE SYSTEM

To design a usable system, planning teams need to conduct activities to address usability goals throughout the system implementation process (Figure 1). These activities should be integrated with the overall system implementation process. It is particularly important to collect information about users during Discovery (Step 1). This information will enable planning teams to understand the scope of users' needs and develop usability requirements to support these needs. Iterative usability testing will confirm whether the data system meets the usability goals. Activities to support usability occur through the system implementation process as presented in Table 1. Details about these activities are presented in this section.
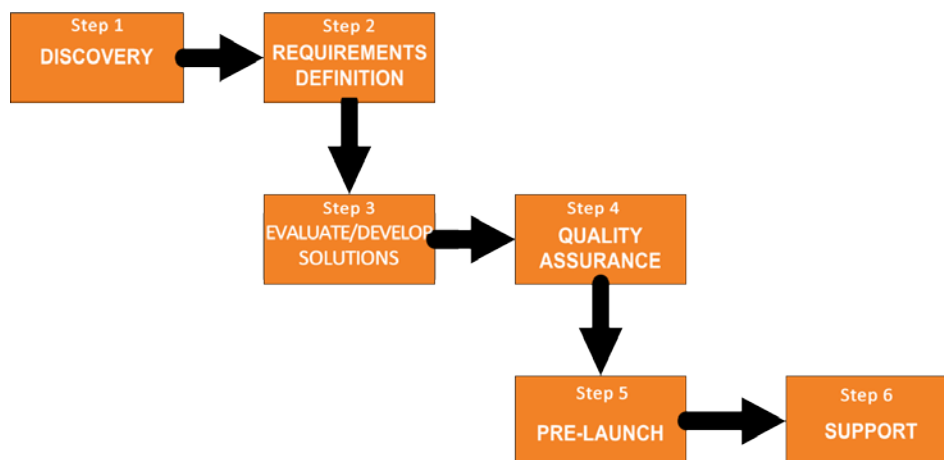
Figure 1. System Implementation Process

Table 1. Activities to Support Usability in Each Step of the System Implementation Process

System Implementation Process	Activities To Support Usability In Each Step
Step 1: Discovery	Define the Users of the Data System
Step 2: Requirements Definition	Develop Usability Requirements
Step 3: Evaluate/Develop Solutions	Define the Users and Tasks for Usability Testing
Step 3: Evaluate/Develop Solutions	Conduct an Initial Usability Evaluation
Step 4: Quality Assurance	Select the Appropriate Data Collection Method
Step 4: Quality Assurance	Collect and Analyze Data Iteratively
Step 4: Quality Assurance	Develop Design Recommendations
Step 5: Pre-Launch	Create Tools to Support Users
Step 6: Support	Collect Feedback

Define the Users of the Data System

Understanding your users and what they will do with a system is critical to user acceptance of the system. During Step 1, Discovery, the planning team should identify the main types of users, their expectations, their primary tasks, and usability goals. Engage a range of users in this process. They can provide valuable insight into the most important tasks that the system must support. This foundational step will help ensure that usability issues are addressed from the start. This information will also inform the development of usability requirements for the engineering design.

There are many methods for documenting users and their needs. One way is through the use of personas. A persona is a theoretical profile of one type of user. Personas help the planning team to focus design decisions around core tasks and usability goals. The information attached to each persona does not have to be highly detailed but should provide enough information so that the user needs and usability goals are clear. For example, if a persona represents a novice user, the usability requirements should specify that the language in the system be simple, that the user interface should be particularly intuititve to use, and that system assists the user to complete their task effectively. The examples below show two personas that may use an adult education data system. You may develop as many as a dozen personas to match the needs of your particular system.

Peter is a program administrator. Every quarter, he reviews the student intake information in the data system for accuracy. He doesn't fully know how databases work so he needs help to approve changes or remove student information as needed, monitor timely entry of information, and track the consistency and accuracy of data.

Role: Program Administrator

Experience with databases: novice

Usability Goal(s):

- Approve addition/removal of intake information within three clicks.
- Select data for producing reports with 100% accuracy.
- Produce activity and data entry consistency reports within 10 minutes.

Keely manages the student and program enrollment data. She uses databases regularly and considers herself an expert. She rarely creates reports but she enters data about new and returning students entering into the program each semester and updates information for students who have exited the program.

Role: Intake Specialist

Experience with databases: expert

Usability Goal(s):

- Enter text and numerical data for a new record within 5 minutes.
- Enter text and numerical data for a new record with 100% accuracy.
- Find a record within 10 clicks.

Usability goals should be based on information gathered during the Discovery step of the system implementation process. Develop goals based on information about users (who are they?), their tasks (what do they need to do?), and measures of success (how accurately or quickly do they need to perform their tasks?). Usability goals should state:

- The specific task that needs to be performed
- The measure of usability success (e.g., within 10 clicks, 3 minutes, 100% accuracy)

This information will help drive your testing activities and shape your usability requirements. After compiling all the usability goals, prioritize those that are "must have" versus "nice to have". This information will help the team to determine which usability requirements will include the term "shall" and which will use the term "should."

Develop Usability Requirements

Usability requirements define what a system has to do to support users' task performance. They supplement the overall system design requirements. Usability requirements specify how a system should work from a user's perspective and should be based on usability goals. Some requirements will be universal, in that they benefit all users while some requirements are included to support particular types of users.

> Usability requirements need to be clear, measurable, and verifiable.

A good starting point for developing usability requirements are human factors design standards and usability guidelines (see Resources section at the end). These resources provide guidance on design principles such as simplicity, consistency, and error tolerance (i.e., features to prevent user errors). The principles are foundational to creating usable systems and should be included as usability requirements. However, they often need to be tailored for the needs of your specific system. For example, a usability requirement to ensure consistency may be: "Lists of information found in several places shall be presented in the same order." Alternatively, a requirement to provide error tolerance may be "The system shall not provide users with illogical choices for filtering information." Task descriptions identified during the Discovery step will help the planning team to identify where usability requirements are necessary. Note that as with any design requirements, usability requirements need to be clear, measurable, and verifiable.

Define the Users and Tasks for Usability Testing

When you are ready to perform your first test (ideally, before developers have even created a prototype), you will need decide on the types of users to include and the tasks to be used. You will need at least five users of each type (identified during Discovery) to perform several tasks (also identified during Discovery) by using the system. These tasks should reflect the typical tasks that users will perform with a similar level of difficulty. Table 2 provides an example of the types of users and tasks that may be appropriate for usability testing activities.

Table 2. Example of User Types and Tasks for Usability Testing

User Type	Users	Tasks
Teacher	10	Enter student contact hours and test scores.
Intake specialist	5	Update the database with several new records and archive old records
Program Manager	5	Create a report describing regional changes to enrollment and retention for the past year. Compare the results against the state targets.
Financial reporting staff	5	Get data about training costs for different programs over the past year and identify trends.
State monitoring staff	5	Check program data for errors and create reports comparing local program progress across programs and in comparison to the state.

Conduct an Initial Usability Evaluation

Prior to conducting the usability test, conduct a usability evaluation. Usability evaluations are different from usability tests because they do not involve users. Ideally, a human factors engineer or a usability specialist should conduct this evaluation. The design is assessed against the best practices in human factors design standards and usability guidelines (see Resources section at the end). The results will highlight where obvious problems exist and provide an opportunity to refine the system design before user testing. This approach also allows planning teams to identify usability issues more quickly and more cheaply prior to initial testing.

Select the Appropriate Data Collection Method

Selection of a testing method will differ depending on the design phase and the types of data needed from users. The planning team will need to identify the types of tasks they will need users to perform for data collection. It is important to remember that the purpose of usability testing is not to see if the user can "get through" the workflow but to see how well the design works to help people perform tasks efficiently and easily. However, it is important to design your test so that the tasks are not too easy but are of the same level of difficulty as in real life.

You do not need to have full-developed prototypes to conduct testing. In fact, early testing, simply using pen and paper or using cards to organize ideas, are valuable for gaining insights into task flows and users' expectations before developers even create the first prototype. Early usability testing will likely collect data about the most appropriate order for a task flow and what users expect to see when they interact with the system. Testing in the middle and later phases of the design process, using more mature prototypes, may use the *think-aloud method* to collect data. The think-aloud method requires users to talk out loud while performing a task so that data can be collected about why users make certain decisions during a task and the assumptions or expectations that users have. This information is valuable for understanding why users have problems and which aspects of the design they like.

Making sense of the data will be critical for decision making. Data collection from the think-aloud method should map users' comments to the relevant tasks and part of the system so that data analysts can understand the information in context. Software packages and online tools (e.g., Morae®, Treejack) may be helpful for collecting and organizing data.

Data from usability tests may be both qualitative and quantitative; both are valuable. Qualitative data—through surveys or think-aloud testing—will tell the planning team about where and why users have a positive or negative experience when using the system. Quantitative data may measure how long a user takes to perform a task, the number of errors made, or how many clicks

it takes to successfully finish a task. These data can inform the team about where the interaction demands are too complex and highlight opportunities to improve user efficiencies.

Collect and Analyze Data Iteratively

Usability testing is most useful when it is conducted several times before a system is launched. Early testing lets the planning team know what types of basic tasks the system should support. Later testing helps the team to test early prototypes, identify usability issues and then refine the design before launch. Iterative testing also helps planning teams to verify whether design changes have resolved usability issues that were identified earlier. Systems that have good usability need at least three rounds of usability testing before launch.

Develop Design Recommendations

Use the results from usability testing to develop design recommendations. They should describe what in the system should change in measurable and verifiable terms, explain why, and the importance the recommendation. Will the system be unusable if the recommendation is not accepted? Or is it a "nice to have"? Explaining why the change is needed helps developers to understand the root of the problem and the expected outcome from the change. In turn, developers may suggest alternative solutions for addressing the usability problem.

Occasionally, changes to a design introduce new usability issues. Therefore, after design recommendations are implemented, the planning team should test again to see if the recommendations have addressed the target issues and whether any new ones arise. This iterative approach will help planning teams to ensure that the final product is acceptable by users.

Create Tools to Support Users

Prior to launching the system, create tools—such as quick reference guides—to help users learn to navigate through the system. These tools will help increase user satisfaction after launch and reduce the need to contact a help desk.

Collect Feedback

Collect user feedback about usability issues after launching the system. Issues that may be undiscovered during initial design or new issues that may arise. User feedback is a valuable source of information for improving the usability of future system designs.

Resources

The following list provides planning teams with more detailed information about usability testing and best practices.

- Usability.gov is a website that provides software and website designers with resources for creating usable systems: https://www.usability.gov/how-to-and-tools/methods/personas.html
- The Nielsen Norman Group is a firm that publishes articles that discuss specific aspects of usability testing and provides tips for successful testing: https://www.nngroup.com/articles/

- The Federal Aviation Administration has published a human factors design standard that provides requirements and guidance for developing software and equipment: http://hf.tc.faa.gov/publications/2016-12-human-factors-design-standard/