User-Centered Design for Research Informatics Tools

A process for building software that’s useful, usable, and appealing (within budget)

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What is User-Centered Design (UCD)?

The user-centered design methodology assumes that products are most successful when they’re created with a deep understanding of their intended users. This typically means including users at every stage of the design process to ensure that the product is useful, easy to use, and appealing to its intended users.

With UCD

- Optimize the product around users and their needs
- Engage users at each stage of the design process, testing early and often
- Improve the product iteratively based on user feedback

Without UCD

- Make assumptions without validating them with users
- Force users to change their behavior to accommodate the product
- No user feedback loop and update infrequently

Reasons for Implementing UCD

LEAN AND COST-EFFECTIVE
Avoid expensive and time-consuming rework

INCREASED USER SATISFACTION
Users value the product more because they helped create it

BETTER SOLUTIONS
Multiple iterations lead to better final results

How User-Centered Design Helped the Marcus Autism Center

Our Design Objective
We sought to design a technically feasible user interface that demonstrated the following characteristics:

USEFUL
exclusive of unnecessary features, and inclusive of all necessary features

USABLE
as measured by efficiency, learnability, memorability, error prevalence, and user satisfaction

APPEALING
a friendly, professional look and feel

Results
The application was successfully developed, launched and adopted without the need for any significant rework. We measured perceptions of the application’s usefulness, usability, and appeal by asking 52 users to rate these aspects on a 0 (worst) to 10 (best) scale:

<table>
<thead>
<tr>
<th>Feature</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Available Features</td>
<td>7.5/10</td>
</tr>
<tr>
<td>Ease of Use</td>
<td>7.7/10</td>
</tr>
<tr>
<td>Look and Feel</td>
<td>8.6/10</td>
</tr>
</tbody>
</table>

User-Centered Design Process

Start
Define Needs
Design and Prototype
Launch
User Testing

After launch, we continued to collect user feedback, conduct user testing, and improve the application based on testing results.

Working under a short development schedule and a modest budget, we aimed to be confident in the design’s probability of success by testing early and often. We tested prototypes before beginning the more costly and less flexible programming phase.

We conducted 15 interviews with Marcus research staff (RexDB users) and stakeholders to understand their specific needs. We also closely observed how they interacted with their old application to identify inefficiencies and frustrations.

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Background
The Marcus Autism Center uses RexDB to manage its research data. We applied user-centered design methods to tailor their application to support the center’s specific needs.

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The box plot shows the minimum and maximum response (left/right tick marks), the first and third quartiles (left/right edges of the box), and the median (vertical line in the box).

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We did the following in each testing session:
- Observe eventual users completing realistic tasks with the prototypes
- Ask questions to better understand their mindset and expectations
- Note the frequency and cause of user errors

As we went through more rounds of testing and refinement, we eventually coded our design into a working prototype and finally a polished application.

Conclusion
By applying user-centered design methods, we built a useful and usable application that was delivered within budget and (almost) on time. During the design process, we interviewed users to define their needs, designed and prototyped using cost-effective methods, iterated and tested with users early and often to avoid expensive post-development redesigns. After the successful launch, we continued to collect user feedback and further improve the application.

Teams designing complex web applications for domain-specific uses, such as autism research data management, may benefit from user-centered design methods.