Abstract

Technology is increasingly embedded into the full spectrum of healthcare. This movement has benefitted from the application of software development practices such as usability testing and agile development processes. These practices are frequently applied in both commercial/operational and academic settings, however the relative importance placed on rapid iteration, validity, reproducibility, generalizability and efficiency differs between the two settings and the needs and objectives of academic versus pragmatic usability evaluations.

Objective

This paper explores how usability evaluation typically varies on key dimensions (e.g., rapidity, validity, reproducibility) in pragmatic versus academic settings and proposes a hybrid approach aimed at satisfying both pragmatic and academic objectives.

Methods

We outline the characteristics of pragmatic versus academically-oriented usability testing in healthcare, describe the tensions and gaps resulting from differing contexts and goals, and present a model of this hybrid process along with two case studies of digital development projects in which we demonstrate this integrated approach to usability evaluation.

Results

Case studies illustrate design choices characteristic of our hybrid approach to usability evaluation.

Conclusions

Designed to leverage the strengths of both pragmatic and academically-focused usability studies, a hybrid approach allows new development projects to efficiently iterate and optimize from usability data while preserving the ability for these projects to produce deeper insights via thorough qualitative analysis to inform further tool development and usability research by way of academic-focused dissemination.
MeSH Keywords: Software design, User-Computer Interface, Medical Informatics
33Introduction

34Academic versus pragmatic usability evaluation

35Technological solutions are a dominant modality for improving healthcare delivery. Technology is increasingly embedded into the full spectrum of healthcare workflows – patient, provider, system and population. The growing integration of technology into healthcare has benefitted from the application of software development practices such as agile development, user-centered design, human-computer interaction, and usability testing.[1-5] These practices are frequently applied in both commercial/operational and academic settings, however the relative importance placed on rapid iteration, validity, reproducibility, generalizability and efficiency differs between the two settings, as do the needs and objectives of academic versus pragmatic usability evaluations.[4 6] With interest increasing in conducting and reporting data from usability studies from an academic perspective, the relevant literature has seen a growing number of publications proposing how best to approach usability research.[4 7-10] This includes an uptick in books published on agile software development techniques and user-centered design, including usability studies, and these concepts are increasingly discussed in relation to the design of healthcare information technology. [8 11]

49While the increased attention is indicative of the potential value of usability research, details on how to conduct usability research in a way that is agile and iterative while at the same time aligned with the goals and demands of academic research remains sparse.[12 13] The gap between academic and pragmatic usability engineering in healthcare represents an important knowledge translation problem which may be at the root of a number of issues regarding lack of usability of systems and lack of end user adoption of many healthcare IT systems.[2 14-16] In
In this paper, we explore the tension between academic and pragmatic usability approaches in healthcare and describe our work which bridges the two approaches, and, as a result, has led to timely, successful changes in clinical information systems in real hospital settings, as well as to the publication of peer-reviewed scientific publications and dissemination of results and methods in the academic arena.

Usability and user research

Usability testing has emerged as an important methodology in health informatics that takes on different forms and assumes different priorities depending on the setting. Usability testing refers to evaluation of a digital tool involving the observation of end users of a system as they interact with that system to carry out representative tasks for the purposes of gathering feedback for user-centered tool development. For example, physicians or nurses (representative users) may be observed and recorded while they carry out a task of interest using the electronic health record system (EHR). Observations made during the testing, as well as the recorded user interactions (typically captured using screen recording software) can then be analyzed to identify specific usability issues, such as problems with navigation or pain points with regard to tool compatibility with user workflow.

A considerable number of studies have been published involving usability testing of healthcare IT since the early 1990's with several decades of research establishing a set of best practices and minimum standards of rigor for usability testing. For example, provide proposed guidelines for conducting and reporting evaluation studies, including explicit consideration of scientific background, study context, detailing of methods, results and the...
Peute and colleagues have extended these ideas to the creation of guidelines for usability evaluations for academic reporting, adding on descriptive data on study participants, and discussion of generalizability and reproducibility of the study. These guidelines and practices can be seen as supporting a move towards a culture of “evidence-based” human factors work in healthcare, as described by Marcilly and other authors, and provide good standards for conducting and carrying out academic studies, where time and resource may be less constrained than in many real-world applications of usability engineering. Many of these practices, such as including a minimum number of representative users that would allow for statistical analyses, and conducting objective and replicable analyses of the resulting data are well-documented in the academic literature. Despite these established practices, however, software development projects in real clinical context continue to routinely minimize the role of truly rigorous evaluation. While academically-oriented usability studies value validity, reproducibility and generalizability, those usability studies conducted in primarily pragmatic settings (e.g. commercial or clinical settings) prioritize speed, efficiency, and the ability to inform rapid or agile development cycles. The differences in priorities reflects differences in both the goals of each type of project as well as the funding source of academic (typically grants) versus pragmatic usability studies. Importantly, these differences can create tension within development teams seeking to meet both academic and pragmatic research and development goals, including many teams at academic health centers with a mandate to produce effective and timely production systems for real-world use in clinical settings and contexts.
While rigorous real-world usability approaches have been developed, there are challenges surrounding the ability to quickly analyze and report on the data collected and this represents an ongoing barrier.[27] As a result, academic usability studies adhering to these best practices may tend to be valued more for their contribution to usability principles than as a tool for use under the time constraints of development processes in pragmatic development projects.

Furthermore, in some clinical settings, usability research is often conducted as part of a larger study where the technology development piece is only one phase of the larger project for which study goals demand rapid prototyping and release of a new tool in order to move forward.[22]

Complicating the tension between pragmatic and academic usability are the varied and often vague uses of the term “usability” in both settings, making it difficult for development teams as well as researchers to align on an approach to usability evaluation and testing. In sum, a lack of common understanding of how to apply usability methods as well as what constitutes effective and meaningful usability testing in real-world clinical contexts compounds this tension.

Misperceptions constraining usability testing research

Widespread application of usability methodologies can improve the digital tools being developed, leading to better healthcare delivery and, in turn, clinical outcomes. However, this potential is constrained by three key misconceptions that rigorous usability testing: (1) must be unreasonably time intensive and cost prohibitive, even for heavily academic projects, (2) is incompatible with the development needs of and flexibility required for rapid digital tool development, and (3) is too complex an activity to be carried out by personnel within a healthcare organization, thereby requiring usability experts or outside consulting services.
Time is one of the most commonly cited reasons for either skipping usability testing altogether or conducting it with a purely pragmatic lens, eschewing academic rigor.[6] Projects that demand rapid iteration and efficient timelines often view usability best practices as too cumbersome to implement in pragmatic settings.[28] In real world clinical settings and both operational health IT development, any usability evaluation completed is often casual and ad hoc with developers making product refinements based on anecdotal comments rather than based on user feedback collected in a planned, systematic process.[7] This type of feedback is of value as evidenced by the popularity of the agile approach; end user feedback collected early and often is key to product success.[1] However, in complex settings such as healthcare, well-planned systematic usability evaluation is essential to successful product build and implementation.[29] In addition to concerns about time and cost burden, advocates of a strictly pragmatic usability perspective cite the need to adapt to real world system development needs, timelines and flexibility as the primary reason for avoiding more rigorous usability testing and analyses. However, a planned, systematic approach does not preclude usability evaluation from being amenable to an agile, iterative approach to development. However, because of misconceptions about time and flexibility constraints with usability evaluation, researchers forgo recording and transcription, thereby eliminating the potential for generating deeper usability findings available only through more detailed qualitative analyses of the data.

Further constraining some organizations’ willingness to embrace more rigorous usability testing is the perception that the organization, being healthcare rather than software development focused, does not have the in-house capacity (e.g. experienced personnel, institutional “know how”) to carry out scientifically rigorous usability testing. The misconception that usability
testing requires highly trained (and expensive) usability consultants within a fixed usability
laboratory may discourage an organization from incorporating rigorous usability testing into
digital tool development. While usability testing may add time and cost to a tool
development project, numerous examples demonstrate the high cost of forgoing usability
testing as these tools run a greater risk of underutilization than tools incorporating systematic
user feedback into design and implementation.

Although the perception that usability testing is by definition costly and time-consuming
persists, advances in collection of data in real world settings, along with streamlined and staged
methods for analyzing the resultant usability data have led to rapid, low-cost approaches to
usability testing. Bayliss and colleagues (2011) have shown that taking testing out of the
laboratory and into real world contexts can both minimize data collection costs as well as yield
higher quality, contextualized usability feedback. Return on investment for conducting rapid
usability evaluation methods can be significant. However, it should be noted that even with a
low-cost, data collection approach, full analysis of video-based usability data can take
considerable effort and time (weeks to months) to complete. The added time and burden
associated with rigorous usability data collection and analysis strategies may be outweighed by
their potential to offer added insights. This is particularly so in projects in complex settings like
hospitals where workflow considerations are a priority or in cases where usability findings have
academic relevance. Our hybrid approach to usability evaluation illustrated below along with
the following case studies of its application demonstrate that through staging, pragmatic
usability testing can occur in a cost- and time-efficient manner, while preserving the opportunity
to follow up with the deeper data analysis needed to glean new academic findings should project goals dictate.

Methods

We begin by outlining the characteristics of pragmatic versus academically-oriented usability testing in healthcare, describe the tensions and gaps resulting from differing contexts and goals, and then present and discuss two case studies illustrating our hybrid approach to usability evaluation in which we successfully integrated these approaches.

Results

Academic vs. pragmatic usability: a comparison of features

Academic and pragmatic usability studies may employ similar methods but can be characterized by several key differentiating features, as detailed in Table 1. Table 1 compares and contrasts features of more rigorous academic usability with those of a purely pragmatic usability approach. The goal of Table 1 is to illustrate essential differences and potential tensions between the two perspectives; however, it must be acknowledged that in reality usability studies vary widely and differences in features between academic and pragmatic usability studies may not be clear cut.

Table 1. Comparison of features of academic versus pragmatic usability testing

<table>
<thead>
<tr>
<th>Feature</th>
<th>Academic Usability</th>
<th>Pragmatic Usability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
<td>Production of evidence regarding adaptation and development of tool types (e.g. CDS) and workflows for academic publication and dissemination</td>
<td>Rapid iterative design and testing cycles to provide user feedback to developers</td>
</tr>
<tr>
<td>Methodological Approach</td>
<td>Priority: rigor and reproducibility</td>
<td>Direct observation and think-aloud; near-live and live testing using low-cost rapid approaches</td>
</tr>
<tr>
<td>-------------------------</td>
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<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Setting</td>
<td>Priority: high-fidelity, representative testing environment and tasks</td>
<td>Priority: convenience over fidelity</td>
</tr>
<tr>
<td>Number of participants</td>
<td>10-15 participants (representative of end users) per user group for usability testing (potentially more if conducting statistical analyses)</td>
<td>&lt;10 participants (typically minimum= 4)</td>
</tr>
<tr>
<td>Data capture</td>
<td>Note taking, audio recordings, video recordings, screen capture</td>
<td>Note taking, debriefing questions, real-time analysis of user screen interaction</td>
</tr>
<tr>
<td>Data Analysis</td>
<td>Detailed qualitative analyses (including inter-rater reliability) of data captured: usability testing transcripts, screen captures etc.)</td>
<td>Concise, structured summaries of findings based on notes from usability sessions and debriefings, notes from anecdotal and stakeholder feedback</td>
</tr>
<tr>
<td>Output</td>
<td>Detailed data tables and results reporting</td>
<td>Simple table of problems and solutions</td>
</tr>
<tr>
<td>Dissemination</td>
<td>Publication of findings in peer-reviewed journals</td>
<td>Final summary report presented to developers and management</td>
</tr>
<tr>
<td></td>
<td>Priority: generalizability of results and scientific value</td>
<td>Focus on “local” (vs. wider) distribution of findings for use to improve a specific system or interface</td>
</tr>
</tbody>
</table>
Methodological approaches, setting and number of participants

The differing goals of each approach has been discussed and serve as a key motivation for this paper. In terms of basic methods, both academic and pragmatic approaches overlap, utilizing usability data collection techniques including direct observation, the “think aloud” method in which users are asked to provide real-time, out-loud feedback while carrying out representative tasks, “near-live” methods which involve use of the tool in clinical simulation in realistic settings, and “live” usability testing in where the tool is usability tested post-deployment, to discern any outstanding issues with design or integration with workflows before wider implementation.[12 19 22]

Further testing involving a broader range of more sophisticated methods may follow think aloud testing, including clinical simulation in which testing occurs under highly realistic (“near live”) or actual conditions of use (“live”), particularly in studies with academic goals.[27 28] In these near-live or live usability testing sessions, a limited number of participants are observed and recorded as they carry out real tasks to uncover deeper issues like workflow not captured by simulated protocols.[22] The setting used for testing may be more elaborate for academic usability with its emphasis on achieving a representative testing environment, while in pragmatic usability testing the realism may be variable and the context of lower fidelity.

However the tools and methods used in more rigorous usability are much the same as those used in qualitative research otherwise; while knowledge and comfort with the principles of usability research are important, internal team members capable of implementing a high quality...
qualitative research protocol can adapt those tools and skills for usability evaluation. The
number of participants also typically varies between academic and pragmatic usability, with the
recommendation for academic usability being a minimum of 15 participants deemed representative of end users of the system while in pragmatic usability testing, fewer participants may be considered sufficient to inform design decisions, particularly if testing is integrated into numerous rapid iterative and agile develop and test cycles.[8 13]

Data collection, analysis, reporting and dissemination

Data collection and analysis is a key area of difference between the two approaches, with academic usability collection likely to be more involved than for pragmatic usability, and analysis more detailed (including calculation of inter-rater reliability, a cornerstone of academic usability). Termination of data collection is based on the achievement of saturation for that iteration of the tool as is common in traditional academic qualitative research, rather than on time and cost considerations as is often the case in pragmatic usability engineering.[13] [33]

The output in academic and pragmatic usability is another key area of difference with the former producing detailed analysis reports for dissemination via peer-review publications, often in addition to the concise summaries of feedback produced in the case of pragmatically focused usability testing. In addition to its utility in the rapid iteration process, summary documents can also be used to capture key quotations from direct user feedback to drive changes in system design. User feedback can also be useful markers indicating potential areas of focus for deeper learning during more rigorous qualitative analysis in the case of academically oriented studies.

While the pragmatic goals of a usability study can be met with this iterative summary
document, the academic goals may demand a full transcription of the relevant usability session along with in-depth analytic evaluation of the variety of data captured (e.g. video, audio transcripts, screen captures, etc.). While time-consuming, the depth and rigor in this type of evaluation is necessary to uncover more subtle usability patterns and insights as well as produce high quality findings fit for academic publication.

Timeframe

Purely pragmatic projects that incorporate usability testing may conduct just one cycle of one type of testing (e.g. one cycle of think aloud testing) with summary memos for prototype iteration but no further analysis of usability data. An academically focused project, on the other hand, may see value in conducting multiple rounds of all three types of usability testing (think aloud, near live and live usability) to achieve data saturation and analyzing audio, video and screen capture data to uncover evidence to support findings relevant to the academic community. Time required from start of data capture to production of results also varies between the two, with academic usability typically taking weeks to months to complete full and formal analyses, while pragmatic usability typically has much tighter time constraints, including a need to provide design recommendations within hours or days of testing if required by production and design cycle schedules.[32]

Hybrid approach

With a hybrid approach, the usability testing phase is tackled in the spirit of rapid, agile iteration while planning for the documentation needs required for deeper academically focused analysis. The analysis can occur later in the product development lifecycle, although ideally before wide release of the optimized system in order to ensure the opportunity for any later findings to find

Figure 1. Hybrid approach to usability evaluation
Our experience suggests combining strategies for testing and evaluation for a hybrid approach to usability testing provides a robust strategy able to balance and satisfy both the needs of academic and pragmatic contexts as illustrated in Figure 1. Our experience using this approach and its value is illustrated in the following two case studies.

Case studies of HIT development projects using a hybrid academic/pragmatic approach

Case studies overview

Two case studies presented here highlight how a hybrid approach to usability testing can address both pragmatic as well as academic goals, resulting in improved quality and capability of healthcare technologies. First, the development of an EHR clinical decision support (CDS) tool designed to reduce inappropriate antibiotic prescribing for upper respiratory infections demonstrates a successful operationalization of rigorous, academic-friendly usability research within a flexible, pragmatic timeframe. Second, a decision support trial embedding goal setting tools into primary care EHR workflows exemplifies how a hybrid approach to usability...
testing during tool development resulted in a highly usable and effective digital healthcare tool while yielding valuable academic insights with regard to establishing new generalizable processes for testing systems. These studies provide novel examples of a hybrid approach that meets the needs of system developers charged with optimizing systems, as well as academic usability researchers tasked with furthering our knowledge and perspective on the role of usability testing in healthcare technology.

Case study 1: The integrated clinical prediction rule (iCPR) decision support tool

iCPR is one of a number of projects aimed at meeting the requirements of both academic and pragmatic usability by employing a hybrid approach to testing. This project successfully applied the full gamut of usability testing methods featured in Table 1 (think aloud, near-live, and live user testing) in the development of an EHR CDS tool (iCPR) designed to reduce inappropriate antibiotic prescribing for upper respiratory infections. In the development period, several rounds of rapid think aloud usability testing were conducted with eight primary care clinicians. The short-term “pragmatic” objective of testing was to identify issues in the tool’s build before widespread release in a hospital setting, while the longer-term “academic” goal was to generate evidence on optimal adaptation of clinical decision support tools. To satisfy the pragmatic needs of the team, looking to take a user-centered approach to the adaptation of the iCPR tool, we employed the “think aloud” method with creation of rapid summary memos for rapid tool iteration pre-deployment. During these sessions, clinician participants were asked to follow a series of scripted tasks within a development EHR environment and to think aloud while using the system to carry out those tasks. After every session, research staff trained in usability evaluation summarized the user’s comments and transformed them into a brief
The summary memo was then circulated among the research team as well as the tool development team to generate potential solutions to usability issues identified in the memo. Suggestions were discussed and corrective actions developed. Usability sessions were conducted until no new meaningful comments were observed for that iteration as reported in rapid summary memos (indicating data saturation was achieved), and no new corrective actions were identified.

Next, several near-live clinical simulations were conducted to reveal deeper level usability issues, such as workflow concerns, that were not revealed in scripted think aloud scenarios. In these sessions clinicians were asked to interact with a video portrayal of a patient (using a video recording of a trained patient actor); this method elicited new workflow issues with the tool that became apparent only once the clinician attempted to simulate real-world workflows. As with the think aloud sessions, these near live usability sessions resulted in rapid summaries of clinicians' comments used by the research team to identify and develop corrective actions quickly and iteratively, again, until no new opportunities for optimization were identified.

In parallel to the rapid iterative optimization process based on the testing findings featured in summary memos, the sessions in both “think aloud” and “near live” usability testing were audio recorded and fully transcribed. This data was analyzed in tandem with screen capture files (recorded using free screen recording software), affording researchers the ability to subsequently conduct synchronous review of audio and video files together allowing deeper analysis and results for production of academically oriented findings suitable for publication in the scientific literature. It should be noted that this longer term work was conducted at the
same time that the results from the initial summaries of changes were being considered for rapid modification. Using principled qualitative analysis methods, including coding for usability themes and issues described by Kushniruk and Patel (2004), this deeper analysis generated insights that confirmed many of the comments captured in the rapidly constructed summary memos, while also producing additional and more detailed explications of usability and workflow issues than were generated from pragmatic usability alone. For example, differences in the sequence of steps used to complete tasks and identification of components of the tool that had particularly poor negative to positive comment ratios were identified by in-depth qualitative analysis of the usability sessions. These workflow barriers had not been uncovered by the rapid scripted think aloud usability session and these insights were used to further refine the tool by the time it was to be released.

These findings demonstrate the ability of formal qualitative analysis of near-live session data to capture workflow sensitive usability problems missed during the scripted (think aloud) usability sessions and pragmatic usability analyses. More complex analyses and insights, though more time consuming to generate, have been valuable for optimizing our overall approach to developing similar CDS systems, and thus provided generalizability of findings essential in academic research. In addition, by the time the iCPR tool was near ready for widespread hospital release (over a several month period) the results from both the rapid pragmatic testing and the more rigorous academic approach had been applied and brought to bear in developing the final software solution. Findings from usability testing have been disseminated via X publications to date in peer reviewed academic journals. [5 17 19 22]
Case study 2: The avoiding diabetes thru action plan targeting (ADAPT) tool

The avoiding diabetes thru action plan targeting (ADAPT) tool provides another example of an application of a hybrid approach to usability testing. The ADAPT tool was designed as part of an NIH-funded decision support trial to support integrated care counseling of pre-diabetes, providing templates within an (EHR) to guide physician-patient dialogues. [35-37] The ADAPT study used the think aloud method to examine usability and workflow issues for eight primary care physicians as they interacted with the prototype ADAPT EHR module during scripted clinical scenarios. These sessions were observed by members of the research team and summaries of issues and possible solutions were created. Initial rounds of think aloud usability testing involved observation of end users interacting with the ADAPT system and provided key insights for software development in a rapid and efficient way. For example, this observation revealed that limited text length in the patient instruction field contributed to generic, non-patient specific content, unconducive to goal setting. As in the case of iCPR, in support of the pragmatic goals of the project we were able to use the real-time summaries from usability sessions to rapidly optimize the tool's usability features (navigation, readability, usefulness, etc.) and remediate major workflow issues. More detailed qualitative analysis of think aloud data suggested that the organization of the diet planning components proved disruptive to subjects’ workflow, a potential threat to provider acceptability. Deeper analysis also highlighted that while lessons learned in earlier CDS studies helped produce a highly usable tool that supports clinician-patient communication, underlying workflow issues persisted, which we hypothesized being a reflection of systematic barriers to integrating these types of CDS systems into real world settings.
Following scripted think aloud testing, summaries from near live usability testing provided additional insights into workflow and communication-related issues. Detailed qualitative analysis of near live sessions (all of which were audio and videotaped; near live sessions used computer capture to record onscreen activity), in which five provider subjects were presented with trained patient actors enacting clinical scenarios involving pre-diabetes counseling, demonstrated that the sequence followed by subjects in the near live sessions tended to follow the path of the documentation flowsheet (an electronic health record data collection form), indicating the appropriateness of the design to elicit use of exercise tools before diet components. However, issues related to workflow also arose from this more in-depth analysis, including issues related to impact on workflow for consultations that were not primarily focused around diabetes. This deeper qualitative analyses of sessions revealed additional important findings not apparent from initial session summary memos obtained from observation as well as provided the data necessary for the rigorous analysis and reporting suited to addressing the projects academic goals. By the time the final software product was released, the input from rapid pragmatic usability testing (creation of summary memos), in conjunction with the detailed academically oriented analysis (detailed coding of the video data, calculation of inter-rater reliability), led to identification of needed modifications that ultimately improved the uptake and adoption of the technology. This is evident in our publication of usability findings and implications from ADAPT EHR in a peer reviewed journal publication.[35-37]

Discussion

In both case studies described in this paper, we observed that applying a hybrid approach to usability testing has been similarly effective in meeting the needs of both pragmatic as well as
academic usability goals. These examples illuminate our proposed practical approach to conducting thorough usability testing cycles that maintain the agility of the iterative design process. At the crux of this hybrid approach, as illustrated in both cases, is the collection of detailed audio and video data amenable to longer term in-depth analysis, while, at the same time, collecting and summarizing information rapidly to drive system improvements in a short time frame (i.e. within hours or days, rather than weeks or months). The pragmatic, post-session summary memos and subsequent group solutioning also supported and was consistent with agile development timelines, while the deeper qualitative analysis of the transcribed audio and video data generated more complex and orthogonal observations and insights for academic dissemination. Results from the in-depth qualitative analyses were applied prior to widespread system release in both projects, but did not impede or preclude an agile development process or timeline.

Conclusions

Academic reports of usability testing are widespread but typically seek to share a new, generalizable idea or principle uncovered during their research rather than nuanced usability findings. Borrowing from industry usability testing practices common outside of academia and from our experience as illustrated by these two case studies, we have demonstrated that a hybrid approach can meet the needs of both by leveraging the rigor of academic usability testing along with the flexibility and rapid agile characteristics of pragmatic usability methods. Teams best able to conduct this type of hybrid work are multidisciplinary and cross-functional, featuring some expertise in design thinking, agile product development, user interaction design, rapid pilot testing and iteration in addition to team members with more traditional research and
While development teams conduct multiple usability testing cycles systematically, each session can be concisely summarized in a rapid fashion for tool iteration and to serve as a growing body of key feedback for the design team throughout the development process. This combined approach allows new development projects to efficiently iterate and optimize from usability data while preserving the potential for these projects to produce deeper insights via thorough qualitative analysis to inform further tool development and usability research by way of academic-focused dissemination.

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Ethical considerations: This research did not involve human subjects and an IRB approval was not required.
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