

Evaluation of an HCD Process Assessment Based on the Content of ISO 9241-221

Process Assessment Model for Human-Centred Design Processes - Proof of concept

HCD Process Assessment Evaluation - Results from a pilot assessment

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An assessment is a useful tool for identifying weaknesses in human-centered design processes. An assessment is performed according to a process assessment model. Now, the latest process assessment model for HCD processes is in its final phase before the ISO standard is published (ISO/FDIS 9241-221). Using a pilot assessment based on the process reference model in the DIN ISO EN 9241-220 standard and the process assessment model, which is designed for the assessment of human-centered design processes, all 24 HCD processes have been analyzed and assessed, checking whether and how well the HCD process assessment model fulfills its purpose (proof of concept) using the previous version, ISO/DIS 9241-221. The results show that the assessment of HCD processes according to the process assessment model in ISO 9241-221 is a useful means for identifying detailed weaknesses in the HCD processes and for producing corresponding optimization opportunities for the HCD processes within organizations.

CCS CONCEPTS • Applied computing • Enterprise computing • Business process management • Business process monitoring

Additional Keywords and Phrases: Proof of Concept, HCD Process Assessment, ISO 9241-221, IUIC HCD Process Advisor

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1 MOTIVATION, BENEFIT AND OBJECTIVE

The goal of usability engineering is to do everything necessary in a development process to steer it towards an optimal quality of use of the final product. With an end-to-end HCD development process, errors and unproductivity can be avoided and product quality increases because a high-quality process output contributes to a high-quality interactive product (cf. ISO 9241-210:2019 [1]). Behind such experiences, a causal relationship between process and product quality is assumed, which consists in the fact that a mature process with a low error probability produces high-quality products than a less mature process.

HCD process assessments are useful for experienced usability & UX professionals as well as other stakeholders to identify which parts of the human-centered design process can be improved to achieve even more focused and productive products with best UX. Process and quality managers are also impacted as they help analyze the findings from the assessment and appropriately eliminate gaps in processes.

The objective was to develop an HCD process assessment model that is officially recognized at the level of an ISO standard and that can be applied by professional assessors to obtain an officially recognized assessment of HCD processes according to ISO 33020:2019 [2]. The results of these assessments are comparable across projects and organizations and describe the capability level of HCD processes in projects of an organization. Hence, the benefits of such a framework are manifold, e.g.:

- Defined requirements for HCD development projects,
- Uniform basis for evaluation,
- Increase of HCD awareness in companies,
- Complete assessment framework for assessors.

During the early phase of development of the HCD process assessment model, the question arose as to whether it could be applied in practice and which findings from the application could be fed back into the development of the process assessment model again (cf. Heimgärtner 2020 [3]). To answer this question, a pilot assessment was carried out based on a concrete project in a medium-sized company. The 24 processes of the HCD process reference model from ISO 9241-220:2019 [4] were evaluated relating to the requirements in ISO/DIS 9241-221:2022 [5] to determine how this upcoming standard is applicable and usable in real assessment contexts.

2 HCD PROCESS ASSESSMENT SETTING

A process assessment represents a disciplined project-oriented evaluation of an organizational unit's processes using a process assessment model. The Human Centered Design (HCD) Process Assessment Model (PAM) is intended for use in conducting process capability adaptation assessments in the development of interactive systems. It has been developed in accordance with the requirements for process assessment models in ISO/IEC 33020:2019 [2] and relates to the HCD process specified in the Process Reference Model (PAM) in ISO 9241-220:2019 [4], which is based on ISO 9241-210:2019 [1]. The latter specifies requirements and provides recommendations for human-centered design principles and

activities for the entire life cycle of computer-based interactive systems intended for those that are responsible for planning and managing projects for the design and development of interactive systems. If processes beyond the scope of ISO 9241-220:2019 [3] are needed, appropriate processes can be added based on the organization's business requirements in future versions of the HCD PAM (ISO 9241-221).

In a process assessment, the process capability is determined. I.e., it is analyzed how good the processes defined in ISO/DIS 9241-221:2022 [5] (based on ISO 9241-220:2019 [4]) perform its purposes according to the rating requirements in ISO/DIS 9241-221:2022 [5] (based on ISO 33020:2019 [2]). The concept of process capability determination by using the HCD PAM is based on a two-dimensional framework. The process dimension (first dimension) is provided by processes defined in the HCD PAM in chapter 6. The capability dimension (second dimension) consists of capability levels that are further subdivided into process attributes in the HCD PAM in chapter 7. The process attributes provide the measurable characteristics of process capability.

The HCD Process Reference Model (PRM) derived from the HCD processes specified in ISO 9241-220:2019 [4] shall be applied along with the HCD PAM when performing an HCD process assessment. The developed HCD PAM contains a set of indicators to be considered when interpreting the intent of the HCD PRM. These indicators can also be used when implementing a process improvement program following an assessment within an organization. The PAM selects processes from a PRM and supplements it with indicators. These indicators support the collection of objective evidence which enable an assessor to assign ratings for processes according to the capability dimension. For detailed information to perform HCD process assessments, please refer to Heimgärtner 2021 [6] as well as to the appendices A.1 for guidelines to conduct assessments in general.

3 CONDUCTING THE ASSESSMENT

To identify the applicability of the HCD PAM in a real assessment context, a pilot HCD process assessment was performed by the author (who is "intacs" certified principal assessor) together with interviewees to get evidence for proofing the concept and the applicability of the HCD PAM. Four participants have been selected as interviewees based on their roles in the company who have responsibility for each of the specific HCD process groups to identify aspects regarding the performance of the assessment discovered during conducting the assessment by applying the HCD PAM. For each process group of the HCD PRM, the responsible person of the project was interviewed. In each interview, the evidence for the achievement of the base practices of the concerned processes were evaluated. For each HCD process of the HCD PRM, the ratings for each base practice have been assigned and the mean and overall rating has been calculated (cf. Heimgärtner 2021 [6]). The scores range from "Not achieved" (N) to "Fully achieved" (F) on a six-point scale according to ISO 33020:2019 [2] (cf. also Figure 1). In the assessment, the participants could explain in his words in what form the support of the system is provided, and the author was able to match these words to the subjects of the assessment report. The pilot assessment was performed remotely with one participant at a time. Each participant was asked to answer the questions by the assessor and share the screen to present corresponding documented evidence if available. The participants were allowed to ask questions but did not receive ratings during the interview sessions. The assessment results were summarized and communicated after finishing all interviews. Technical terms in the base practices new to the interviewees puzzled them. These have been explained to the interviewees by the assessor which reduced the remaining interview session time.

4 RESULTS FROM THE PILOT ASSESSMENT

Figure 1 shows the assessment results from a content point of view for all 24 HCD processes defined in the HCD PRM.

Process	HCP.1		HCP.2		HCP.3										HCP.4									
	HCP.1.1	HCP.1.2	HCP.2.1	HCP.2.2	HCP.3.1.1	HCP.3.1.2	HCP.3.1.3	HCP.3.1.4	HCP.3.1.5	HCP.3.2.1	HCP.3.2.2	HCP.3.3.1	HCP.3.3.2	HCP.3.3.3	HCP.3.4.1	HCP.3.4.2	HCP.3.5.1	HCP.3.5.2	HCP.3.5.3	HCP.4.1	HCP.4.2	HCP.4.3	HCP.4.4	
BP1	N	L	N	L	P	P	N	P	P	P	L+	N	N	P+	L+	P	L	P	P	L	N	P	P	
BP2	N	N	N	P	P	P	P+	P	P	P	L+	N	L	P	L	P	L	P	L+	P+	L	N	L	P
BP3	N	P+	L	N	P	P	N	N	P	P	L+	L+	L	P	P	P	N	P	L	P+	L+	N	L	P
BP4	P	P+	P	N	P	P	P	N	P	L	L+	L	N	P+	P	P	N	N	P+	P+	L+	P+	N	P+
BP5	P	N	P	N	P	N	L+	P+	N	P	N	L	P+	P	L+	P	N	L	L+	P+	L	N	L+	
BP6	P	L	P+	L	P	N	P+	P	N	P	N	N	L	L+	P	L	P	P+	P+	P+	P+	N	P+	
BP7		L	N	N	P+		N	L	N		L+	P+	L+	L+	P+	P+	L+	P		L+	P+	P+	P+	
BP8							P+		N		L+	P+	L+	P+	P	P+				L+	P+	P+	P+	
BP9							P+		P		L+	P			L+					L+	P+	P+	P	
BP10									F		L+	P+			P+					L+	P+	L	L+	
BP11									F		L+				P+					L+	P+	L	L+	
BP12											N									P+	P+	L	P	
BP13											L+									L+	P+	L	L	
BP14											P+									L+	P+	L	L	
GPI.1	P	P+	P	P	P	P	P	P	P	P	L	P+	P+	L	L	P	P+	P	P+	P+	P+	L	P+	P+
PA1.1	P	P+	P	P	P	P	P	P	P	P	L	P+	P+	L	L	P	P+	P+	P+	P+	L	P+	P+	P+
CL	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	0	0	1	0	0	0
	HCD in Business		Institutionalize HCD			Establish HCD Objectives				Identify user groups		Identify user needs		Specify user-system interaction		Plan evaluation		Introduce system						
			HCD Integration		Manage threats		Define HCD activities		Identify context of use		Specify user requirements		Produce design solutions		Create evaluation strategy		Do evaluation		HCD in operation		HCD in upgrades		HCD at end of life	
			HCD Resources		Plan HCD activities				Negotiate user requirements															

Figure 1: Ratings for the base practices and the process attribute for capability level one for all 24 HCD processes

In the consolidation sessions, the rating according to HCD PAM up to process capability level 1 could have been performed as planned in time. This means, the preparation, executing and summarizing the results (reporting) can be performed for HCD processes defined in the HCD PRM using the HCD PAM similarly to other official and standard assessments according to ISO 33000 series. Also, the effort is similar (even this clearly depends on the defined scope of the assessment together with the sponsor). The fact that for each base practice of each HCD process a rating was possible based on the provided evidence during the (even timely reduced) interview sessions shows that the base practices were formulated and documented in HCD PAM in a way that was understandable by the assessor as well as by the interviewees to get reasonable answers and evidence in adequate time. This also indicated that the assessor was experienced enough in the HCD domain to map the HCD processes of the HCD PRM to the evidence that are provided by the interviewees of the project in the organization in adequate time in order not to blow up the assessment interview sessions. The results also showed that the level of detail of the interview questions based on the base and generic practices was reasonable to obtain sufficient detailed evidence for deciding the fulfillment or non-fulfillment of the requirements of the HCD PAM and to determine the process capability for all HCD processes as well as to derive adequate and appropriate measures for HCD process improvement. Furthermore, the results are structurally comparable with assessments performed according to ISO 33000 series, which means that both the productivity of the HCD processes and the HCD engineering chain as well as their competitiveness can be compared.

5 LIMITATIONS AND DISCUSSION

There have been identified aspects regarding the performance, duration, and effort for HCD process assessments as well as to the quality of evidence using oral and documented information. However, several factors are limiting the significance of these results. First, each human-centered process group was assessed with only one responsible person for the whole process group. Therefore, there could be rating inaccuracies due to the assessment being influenced by the individual perception of the participants instead of having talked to the correctly corresponding stakeholders. Second, even though an experienced principal assessor performed the formal assessment, the individual perception of the assessor could also have impacted the ratings because no co-assessor was available during the assessment and in the consolidation phases (even if planned). Third, due to time and human-resource constraints, the assessment was performed in a shorter amount

of time than usual. Forth, due to the minimal time slot provided by the interviewees, the assessor did not have the time to check each piece of evidence and document for the tasks related to the base practices in detail as it is necessary for doing an official standard assessment in full depth. Fifth, due to time constraints, the author could not extensively investigate documented information related to each base practice in detail - only control samples could have been collected. The assessor had to do sample checks and had to rely on the statements in the interviews by the interviewees rather than be able to extensively check documented information. Therefore, the ratings are based on the statements of the interviews and the information provided by them. Finally, due to the limited time frame of this pilot assessment (only 4 days in total in 2022 in an industrial HCI project), it was not possible to identify all possible implications for the application of the HCD PAM in detail.

Nevertheless, even if the reliability of the assessment rating is redeemed as there is less information about the validity of the evidence provided by biased interviewees, this aspect does not limit the results regarding the aspects concerning conducting the assessment. The time was sufficient to get the reliable impression as well as the proof that the HCD PAM is practically usable, and the rating is applicable in reasonable time. Using powerful tools can increase the productivity of performing the assessment. Therefore, the author developed an adequate tool for this purpose. Further information about this HCD advisor tool can be retrieved from the author directly (cf. IUIC web page, www.iuic.de).

6 RECOMMENDATIONS

It is very reasonable to deploy professional assessors that have appropriate education, training and both assessment skills and HCD domain experience to perform the required class of assessments and make professional judgments (cf. ISO/IEC 33001:2015 [7], clause 3.2.11). Especially at least one lead assessor (cf. e.g., www.intacs.org for an INTERNATIONAL Assessor Certification Scheme) is necessary who has demonstrated the competencies to perform an assessment and to monitor and verify conformance of a process assessment (cf. ISO/IEC 33001:2015 [7], clause 3.2.12). Without them, HCD process assessments may not be productive and cannot be standard HCD process assessments compliant to ISO 33000 series.

7 CONCLUSION

The investigated HCD PAM (ISO 9241-221) for the development process of interactive products serves to assess the process quality in HCD development projects based on objective indicators for process capability and thereby to achieve quality of use referring to the HCD processes defined in ISO 9241-220:2019-03 [4]. The pilot assessment has shown that the concept of the HCD process assessment model together with the HCD process reference model in ISO/DIS 9241-221:2022 [5] is working fine. When applied by an HCD experienced assessor who is well-trained for performing process assessments according to the ISO 33000 series, it is possible to get comparable and hence, officially usable HCD process assessments results that can be compared between organizations worldwide.

8 OUTLOOK

Based on the results and findings from the pilot study, tools for conducting HCD process assessments in accordance with ISO/DIS 9241-221:2022 [5] will be adapted, tested, and optimized in further pilot assessments to increase assessment productivity. As soon as ISO 9241-221 is officially available, official standard assessments according to ISO 33000 series can be performed by appropriately trained and certified lead assessors with experience in the HCD domain and knowing the HCD processes. Future improvements to the HCD PAM regarding wording and adding additional useful notes can be determined by experienced and certified assessors by applying the HCD PAM in numerous assessments over time.

Furthermore, the impact of upcoming findings based on such HCD process assessments should be evaluated and submitted to the ISO committee for the next review cycles of ISO 9241-221. This can also be supported, e.g., by annually assessing organizations that use assessments for improving the status of the implementation of their human-centered practices as well as optimizing their HCD processes.

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A APPENDICES

A.1 General Guidelines for Conducting Assessments

1. Give positive recommendations for action
2. Select relevant stakeholders for interviews
3. Plan, coordinate and communicate the agenda early
4. Turn on camera during discussion/consolidation to get to know each other in online assessments
5. Consider time shifts in the intercultural context
6. Strive for consensus building in consolidation meetings in case of different expert judgements
7. Be empathic, remain friendly and fact oriented
8. Observe time management (even more difficult in intercultural contexts)
9. Plan sufficient time because of language issues (e.g., partly real time translation or online translation necessary)
10. Plan sufficient time for interview sessions (too short interview times deliver too low quality of assessment results)
11. Plan sufficient time for feedback and final assessment report preparation