On the Role of Communication, Documentation and Experience during Testing - An Interview Study

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On the Role of Communication, Documentation and Experience during Testing - An Exploratory Study

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Abstract

Nowadays, the quality of software is becoming more and more a competitive factor. As complete testing is impossible, testers have to make decisions, e.g. to choose which parts of the software have to be tested in which way. For this purpose, testers need a lot of information, such as input documentation which serves as a basis for the derivation of test cases or information on the project status which serves as a basis for planning the testing process. Thus, testers rely on up-to-date and complete information in order to make sound decisions. Consequently, the quality of the testing process depends on the quality of the information sources available for the testers. This report presents the results of an exploratory study conducted during the SIKOSA research project with expert testers of our industry partners in order to identify the most valuable sources of information during testing. Particularly, we conducted interviews in order to investigate which documents are often used by testers, as well as the role of communication and experience. Our results show that defect reports are very valuable. User manuals and problem reports are equally important, because they represent real usage of the software and serve testers as an input for realistic test cases. In addition, our results show the influence of an independent testing team on test process characteristics.

1 Introduction

Spectacular software failures like the crash of the Ariane 5 rocket [Do97], but also software failures which occur daily in business software show that testing activities are essential in order to detect defects before release. However, complete testing is impossible, and as a consequence, testers have to make a lot of decisions during the testing process in order to constrain the set of potentially infinite number of test cases to a set which can possibly detect the most critical defects. Thus, testers make decisions, e.g. on the test design technique to be used in order to derive test cases or on the test data which serve as input for test cases. In order to conduct all these decisions thoroughly, testers need complete and up-to-date information, e.g. about requirements, project status, etc. The main assumption of our work is that *the better the information and the information flow between testers and other project members (e.g. requirements engineers or project manager) is, the better will be the quality of the decisions made*

during testing. The knowledge of testers' information needs allows to provide testers with the right information at the right time and to define the best way of providing it (e.g. documented, verbal). Based on this knowledge, test process improvements can be designed and implemented.

In this report, we present the results of an exploratory study, performed during the SIKOSA research project with expert testers, the aim of which is to analyze information flow within the testing processes. Particularly, we analyze which documents are frequently used and which roles are consulted when making decisions during testing. In addition, we investigate the role of experience needed to make sound decisions. The results of the study serve as a basis for recommendations regarding the optimization of a testing process.

The remainder of this report is organized as follows. Section 2 introduces a conceptual decision framework, containing decisions to be made during the testing process. We used this framework as the basis for our study during data collection and analysis. In Section 3, related work is presented. Section 4 describes the design of the study. We conduct expert interviews for exploring information flow patterns in testing. Section 5 presents the analysis and results whereas Section 6 deals with the threats to validity of our study. Finally, Section 7 concludes the report.

2 Decisions within the Testing Process

This section introduces some basic concepts and the decision framework which served as a basis for the exploratory study. In previous research work, we analyzed the testing process [IHPR05], [BIL07a], [BIL07b] and developed a decision framework, which identifies the decisions to be made during the testing process and assigns them to decision levels.

Test planning and control (TP&C). Since testing is a complex process, thorough planning and monitoring is needed. Consequently, during TP&C activities testers decide on schedules, resources, and efforts estimated for testing activities, as well as on risks (which threaten the successful completion of the testing).

Test strategy definition (TSD). The main goal of TSD is to define which parts of the software should be tested in which way (e.g. how intensively or with which test design techniques) in order to find the most critical defects fast. Correspondingly, testers decide on test end criteria, defining conditions which have to be fulfilled to finish testing activities. In addition, decisions on the test design techniques used to develop test cases (to find the most critical defects) have to be made and a test model can be selected. A test model, e.g. a state model facilitates the derivation of test cases. Closely related to the selected model, the decision on the representation for the model, as well as coverage criteria, e.g. transition coverage or state coverage in case of a state model can also be decided during TSD. In the case of automation, testers also have to decide on the degree of automation.

Test analysis and design (TA&D). During test analysis and design activities, testers decide on test cases including test steps, test data and test sequences. In addition, testers review the documentation to be used as input for testing activities and decide on their quality, e.g. testers make decisions about the testability of the requirements specification

document. If the requirements specification does not fulfil the required quality from the testers' point of view some rework is needed.

Test execution (TE). During test execution, decisions on the evaluation of the executed test cases (called test runs) have to be made. Consequently, testers have to decide, whether a test run revealed a defect or not.

Test cycle evaluation (TCE). During test cycle evaluation, the results of the test runs have to be analyzed. Thus, testers check if the test end criteria have been fulfilled and decide whether testing activities can be finished or not.

3 Related Work

Similar work, analysing information gathering strategies of maintainers is described in [S202] and in [TL01]. Most related work focuses on the description of the test process, e.g. the fundamental test process presented in [SLS06] addresses phases and activities to be passed through when testing a software system. The IEEE standard for software test documentation [IEEE98] specifies all artefacts to be created during the testing process, e.g. the test plan; the information flow, as well as the information sources needed are not part of the standard. Another group of related work represents test process improvement models like TPI (Test Process Improvement) [KP02] or test maturity assessment models, e.g. TMM (Testing Maturity Model) [BSC96]. The focus of these models is not the information flow within the testing process, but the steps for its improvement, respectively on criteria to assess the maturity of the organizational testing process. None of the presented references contains empirical studies. The work which is most related to our work is [Da05]. The authors present guidelines for requirements engineering practices which facilitate testing. In contrast to the work in [Da05] which addresses requirements engineering processes and artefacts, this study has a larger focus including other information sources of the software development project. In addition, we analyze communication, as well as the role of experience during testing. To our knowledge, this is the first study exploring the information flow during the testing process in detail. Empirical studies are essential in understanding the nature of information processes. This is also the case with the testing process. By this study, previously formulated advices in literature which are not supported by empirical studies could be confirmed. For example, the outstanding role of the requirements specification and of previously found defects for the testing process could be confirmed. This study, however, also allows insights which have not been yet considered in literature, e.g. the role of the user for testers. Knowing that information from customer is so valuable for testers, processes can be adapted appropriately in order to facilitate the information flow from customers to testers.

4 Study Design

In this chapter, we present the research questions; we introduce the characteristics of the participants of the exploratory study and provide an overview of the data collection and data analysis methods used to gather and to investigate the data.

4.1. Research Questions

In the following, research questions to be answered by this study, as well as practical motivations and hypotheses are listed.

Table 1: Research Questions

Questions	Rationale
Q1: Which documents are frequently used by testers when making which testing decisions?	The main assumption of this research question is that documents are an important information source for all participants of the software engineering process, including testers. To know which documents are frequently used by testers is important, because quality assurance activities concerning information sources often consulted by testers can be intensified purposefully.
Q2: What role does communication play as an information source?	The main assumption of this question is that documentation is never completely sufficient as input to the testing process, so that details have to be clarified in face-to-face discussions. And even if documentation was complete, up-to-date and unambiguous, communication is often prefered to reading documents.
Q3: What is the role of experience in testing?	This is an important question to be analysed, because it is important to know to what extent and for which decisions testers rely on their experience instead of documentation. Knowing this enables to decide: Which activities are suited for test automation? Which decisions are suited to be executed by novice testers?

4.2. Participants

The main criterion for the selection of the participants was their experience in the testing area. As a consequence, all participants out of five organizations had at least three years of experience, and most of the participants had five to ten years of experience. Three participants had even more than ten years of experience. Table 2 summarizes the characteristics of the participants. Organisation A and E develop standard software, whereas the other organisations develop individual software. Only organisation C develops software for in-house use. The testers in organisation A work on the same project, whereas the testers in the organisations C and D work on different projects.

Table 2: Participants' Characteristics

Experience (in years)	Role(s)	Main Tasks	Organisation
>10	Test designer	Test planning Test case design Manual test execution	D
>10	Test designer	Test planning Manual test execution	D
>10	Test manager	Establishment of a standard testing process including supporting tools	B

Experience (in years)	Role(s)	Main Tasks	Organisation
>10	Tester, Test manager	Test planning Manual test execution	E
10	Test manager, Quality engineer	Test planning Test case design Monitoring system operation	D
10	Test manager, test designer	Test management and control Test case prioritization Human resources management and motivation	A
5	Test manager	Product development, Manual test execution and protocol Coordination of testing activities Product roll-out (= deployment in the productive environment)	C
5	Test designer	Supports test manager in planning activities Test case design Manual test execution and protocol	A
5	Test designer	Test case design Execution of test cases Fault localisation Regression testing	D
3	Test automation engineer	Manual test execution and protocol Test automation: implementation of the test automation framework	A
3	Test manager	Test planning Manual test execution	C

4.3. Study Process

The study was performed as a qualitative study. Qualitative studies use data in form of text, images and sound drawn from observations, interviews and documentary evidence, and analyse it using methods that do not rely on precise measurement to yield their conclusions [Se99]. We used this research method because it helps to gain more experienced with the analysed phenomenon. In our case, our goal was to get a deep understanding of the information flow during the testing processes.

The study was conducted in the form of seven face-to-face interviews and one telephone interview. Three interviewees completed the questionnaire “offline”. The

interviews were semi-structured, based on a questionnaire sent in advance to the participants. The interviews took three hours on average.

The questionnaire itself consists of three parts. The first part contains questions regarding the testers' experience and role in the organization, as well as questions on the organizational testing process. Particularly, the interviewees were asked about the testing decisions to be made during the testing process in their particular organisation. The second part of the questionnaire addresses communication and documentation sources during testing, whereas the third part contains questions regarding the role of experience within particular activities. In the second part of the questionnaire, the interviewees got a list of documents that could theoretically be used during testing decisions, e.g. requirements specification or design specification. Then we asked the interviewees which documents are needed when making particular decisions. The interviewees were also asked to indicate documents not contained in the list, as well as a "wish list" containing documents currently not available to them. Similarly, we asked the interviewees which specific roles are consulted when making particular decisions. In the third part of the questionnaire, we asked the interviewees to rate the experience needed to make particular decisions.

Data Collection. In the data collection phase, field notes taken during the interviews were coded and stored in a study data base. Coding [Se99] is a procedure which transforms qualitative data into quantitative data by assigning values to qualitative statements. This allows the combination of qualitative and quantitative methods for data analysis. During the coding, interviewees were contacted when ambiguities in the data occurred.

To assure the validity of our results, we used multiple information sources for evidence as recommended in [Yi03]. Thus, beside interviews, document analyses have been performed. We analyzed test case specification templates and test case specifications, test protocols and test process descriptions, as well as input documentation, e.g. requirements in the organization, the testers belong to. Furthermore, we got insight into other information sources like discussion forums. Another aspect considered to assure validity was the representativeness of the interviewees with regard to their qualification, experience and testing tasks. All interviewees are experienced testers, four of them with more than ten years of testing experience.

Data Analysis. For the data analysis, we used different qualitative and quantitative analysis methods. Quantitative methods were used in order to determine patterns and tendencies in the data, e.g. by counting which role is consulted most of all during the testing process. Qualitative methods were used to search for an explanation for these particular tendencies. Thus, we performed cross-case analysis [Se99] and partitioned the data into different categories by using different criteria, e.g. we partitioned the data depending on the testing group's organization as an independent team or not.

5 Analysis

In this section, the analysis of the results of the study is presented. First, we detail the test process characteristics, including the roles and decisions mentioned by the interviewees. Then, we discuss the documentation, communication and experience characteristics. Finally, we present the problems during the testing process as mentioned by the interviewees.

5.1. Test Process Characteristics

Test planning and control. With the exception of risk analysis, all decisions to be made during TP&C (as described in section 2) are equally often mentioned to be performed. 9 out of 11 interviewees mention that a particular decision is made during the testing process in their organization. Only about half of the interviewees (6 cases of evidence) cited that a risk analysis is performed when deciding on relevant risks influencing the testing project. Only 4 of the interviewees report that all TP&C related decisions are in the testing team's field of responsibility. Three interviewees even indicate that all TP&C related decisions are performed by persons not belonging to the testing team, mostly by the project manager. In all other cases, TP&C related decisions are partially made by the testing team.

Test strategy definition is a task not well established within the testing processes we analyzed. Only few decisions are indicated to be made, where the definition of test end criteria is a decision mentioned most by the interviewees (9) followed by the selection of the test design technique (5). All other activities are rarely cited.

Test analysis and test design. Decisions on test steps, on test data and on test sequences are indicated to be made by nearly all interviewees, whereas the assessment of the testability, as well as the assessment of the quality of the input documentation is indicated only by about half of the interviewees. These decisions are mostly made by the testing team. Within organizations not having an independent testing team, these decisions are performed by developers (where the "tester" is not the developer of that particular part of the software). Since most organizations do not automate tests, the realization of test cases and consequently all decisions related to test automation are confirmed only by a small part of the interviewees.

Test execution and test cycle evaluation. All interviewees report to make decisions concerning the success or failure of particular test runs. The decision on the test run evaluation is mostly made by testers, in some cases by the whole testing team. The evaluation of a test cycle is only performed by fewer than half of the interviewees.

To sum up, it is not surprising that decisions indicated to be made by almost all interviewees concern test decisions in the narrow sense (test case definition and test execution). However, TP&C, as well as TA&D related decisions are each indicated to be performed on average by 9 out of 11 interviewees. Decisions concerning the TCE, as

well as the TSD are made on average by fewer than half of the interviewees. Figure 1 shows the test process characteristics as mentioned by the participants.

5.2. Documentation Characteristics

TP&C related decisions, particularly decisions on effort and schedule, require the most documentation, followed by TA&D decisions, especially decisions on test data and test steps, as well as on the definition of test sequences. The interviewees report a high need of documentation during TCE, especially the requirements and design specification. Decisions during TSD and TE require little documentation.

The role of the requirements specification. The requirements specification is by far the most important document for testers (46% of all decisions need the requirements specification as input, see also Figure 2.). During TP&C, the requirements specification is especially used for decisions concerning effort estimation and scheduling, whereas during TA&D the requirements specification is especially used to decide on test cases (including test steps, test data and test sequences). In addition, the requirements specification is also used during TE in two contexts. First, when testers are pressed for time, they report to use the requirements specification as test specification. In this case, decisions on the test design are made concurrently to the test execution. Second, in case of a failure or of an unexpected behaviour, testers consult the requirements specification in order to analyze if it is a real failure. All testers emphasize the importance of the requirements specification to be up-to-date and complete.

Learning from defects. Previously found defects are a very valuable information source for testers, whereas both defects found by the test team, as well as defects reported by customers are almost equally important (25%, respectively 24% of all decisions require customer problem report respectively bug reports as input, see also Figure 2). Testers report that previously found defects are good indicators for defects in the software because of following reasons:

(1) Many defects persist across different versions. Two categories of persisting defects are reported by testers: *permanent defects*, which occur across all versions and *"jumping" defects*, which regularly "jump" over a constant number of versions.
(2) The correction of a defect introduces more defects.

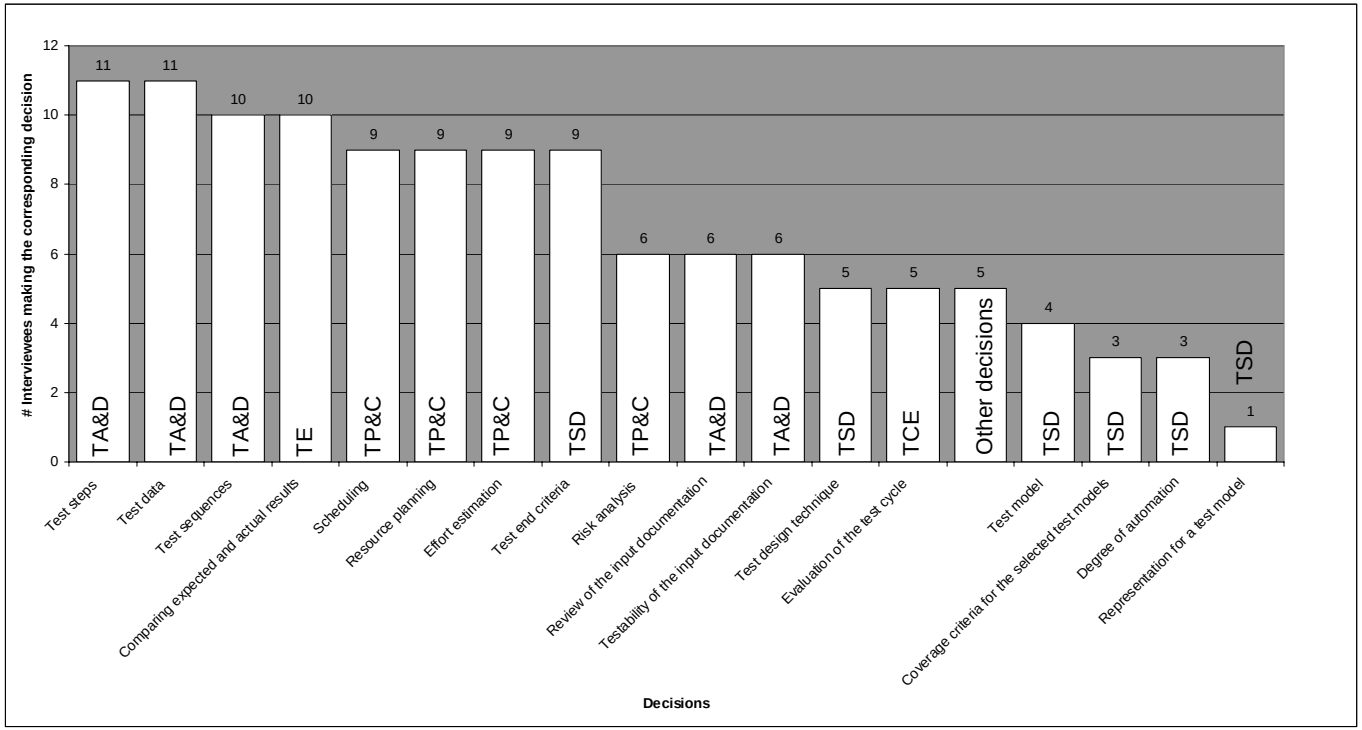

Figure 1: Test Process Characteristics

Knowing potential defects, testers can decide on the test effort to be spent to test particular areas of the software. Defects also serve as input for TA&D. On the one hand, testers select test cases to be re-executed if they revealed a defect. On the other hand, testers develop new test cases on the basis of known defects using different strategies, which we refer to as *intensifying, expansion and transferring.*

(1) *Intensifying:* Testers investigate the functionality more intensively and usually vary the test data, for example, or the preconditions of the test case.
(2) *Expansion:* Testers search for functionality used by the functionality which revealed the defect or using this functionality.
(3) *Transferring:* Testers search for similar functionality (which could contain the same defect).

Figure 2 illustrates the documents needed as input during testing as mentioned by the interviewees.

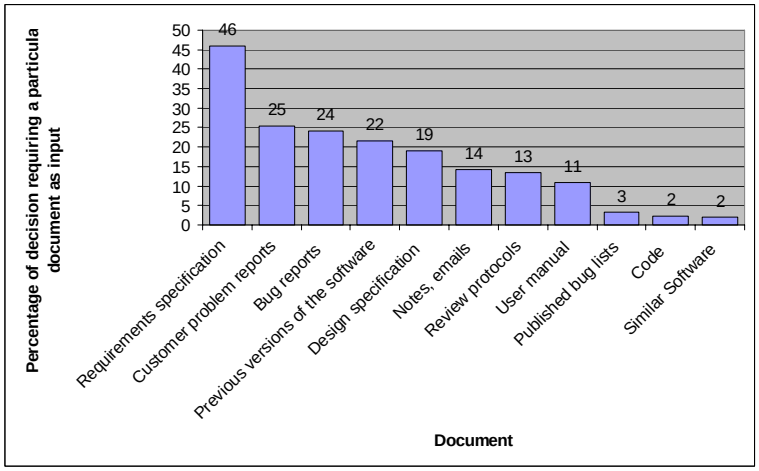

Figure 2: Documentation needs during testing

The role of the user within the testing process. Even though only few of the testers are in direct contact with users, the users play an important role during testing. Using documentation produced for and by users, testers can develop more realistic and more relevant test cases. Thus, testers bridge the gap to the customer by using customer problem reports and user manuals in order to develop realistic test scenarios and in order to define test environments and configurations close to the real productive environments. Consequently, this documentation is very valuable when deciding on test data and test steps. One interviewee also mentioned to use the user manual to get familiar with the software system.

Wish lists. When asked for information sources, which are not available but which were useful for testing, 4 interviewees emphasize that up-to-date and complete requirements are crucial and more important than other documented information sources.

Interviewees cite following reasons why requirements specifications are usually not up-to-date and complete: time pressure at creation time, as well as the fact that requirements engineers are not aware of the tester's information needs.

5.3. Communication Characteristics

During the testing process, most communication occurs among the requirements engineer and the project manager followed by the developer. Testers have direct contact with the customer only when the customer is "in-house". Apart from this, there is no direct communication between testers and customers, in spite of their request for this type of communication. Figure 3 shows the percentage of decisions in which a role is involved.

Most communication is reported to take place during TA&D, where the main communication partners mentioned by the interviewees are requirements engineers and project managers. However, during TE, there is also a great need for communication. The main contact persons are requirements engineers and developers mostly in the presence of a failure. Communication during TP&C occurs mostly with the project manager. However, little communication takes place during TSD and TCE.

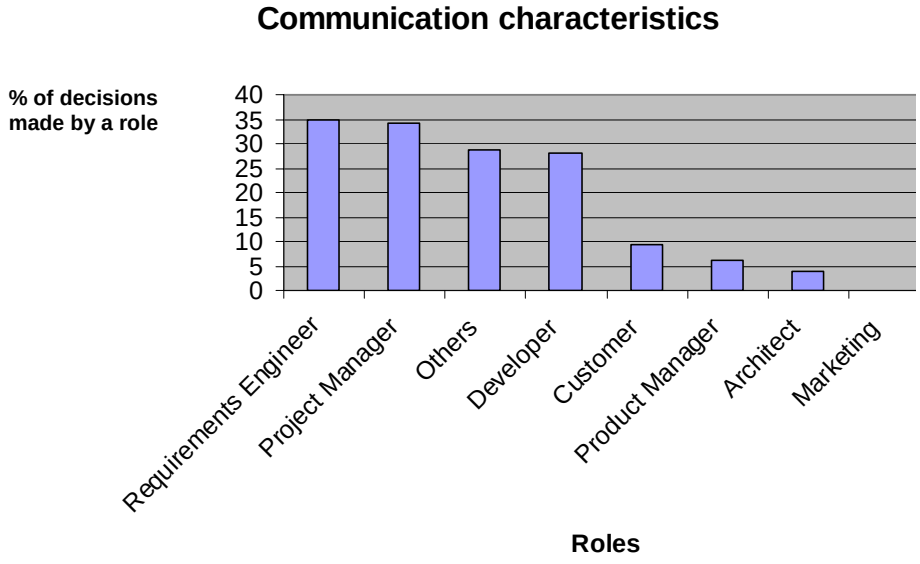

Figure 3: Communication Characteristics

5.4. Experience Characteristics

The interviewees report that most experience is required during TP&C and during TCE. In addition, a lot of experience is required for TA&D. In contrast, little experience is required for decisions related to TSD and to TE.

Among the decisions made during the testing process, the definition of test data is stated to be the decision which requires the system specific experience at most. All interviewees indicate that this decision requires very much experience. In addition, this is the only decision which solely requires system specific experience. Effort estimation and risk analysis, as well as the evaluation of the test cycle are also indicated by the interviewees to require high system specific experience. In general, almost all decisions require more system specific than general experience. Managerial activities, e.g. scheduling, resource planning and effort estimation require the most general experience. As expected, test case execution and evaluation require the least system specific and general experience.

5.5 Problems

In the following, the main problems as mentioned by the interviewees are presented.

Poor quality of the documents used as input, especially poor quality of the requirements specification is one of the major issues during testing. We asked the interviewees to indicate the most severe problems occurring during testing. One of the most frequently mentioned problem concerns the quality of the input documents, particularly the lack of quality of the requirements specification. Only two participants do not indicate poor requirements (e.g. incomplete, unambiguous) as one of the most difficult problems during testing. Three participants especially require more detailed descriptions, particularly concerning pre- and post conditions of a requirement, as well as dependencies between requirements and between the software and its environment (including the software and hardware environment). One of the main reasons for the poor quality of the requirements from the testers' point of view is the lack of involvement in the review process. Only half of the interviewees report that testers are involved in the review process. In one special case, the requirements specification is not reviewed at all.

Testing decisions require system specific experience. Almost all decisions require more system specific than general experience. In addition, testers indicate to rely on their own experience, rather than on experience made by others, as they do not frequently consult published defect lists.

Testers rely on their own experience more than on test design techniques when deciding on test data and test steps. Testers rely more on their own experience than on test design techniques which generate a high amount of test cases and prefer an exploratory-oriented approach. In addition, in the case of time pressure, testers deviate from systematic approaches and reduce the set of test cases according to their own experience. For example, the testers apply equivalence partitioning results in 6 equivalence classes and rate 4 of them as unrealistic and with low potential to detect defects. In this case, they decide to specify and execute only these two test cases which they appraise to be well suited to reveal a defect.

High documentation and communication needs during test execution suggest incomplete descriptions of the expected outcome in test case specifications. Reasons for this are either quality deficiencies in the documentation which served as input for decisions on test cases or shortage of time when testers decided on test cases, leading to incomplete descriptions of the expected outcome.

The results of a test cycle can not be objectively assessed. Surprisingly, testers point out the role of experience in the evaluation a test cycle. One would expect that the evaluation of the test results requires "only" a decision on the efficiency of the test strategy, i.e. "Have the test design techniques been applied and have the test end criteria been met?" But since the test strategy definition is not well established in testing processes, the decisions related to TSD have to be taken later, namely during the test evaluation. In addition, one participant criticizes the lack of a systematic learning process across test cycles.

6 Threats to Validity

One threat to validity of our study is the fact that the results may be specific to the particular interviewees. We addressed this problem by selecting very experienced testers for the interviews. Another threat is the ability to generalize the results due to the fact that we selected a small population. We addressed this problem by using techniques which assure validity of qualitative studies [Se99], [Yi03]: 1) Diversification: Diversity with respect to the focus of the activities performed by the interviewees was a key criterion when selecting the participants of the study. 2) Methodological triangulation: We used different methods to analyse the data (quantitative and qualitative techniques, as described in Section 3.3). 3) Explanatory triangulation: by trying out several explanations for all results in Section 4. For example, the result, that the requirements specification document is a key information source for testers can be confirmed by several facts. First, asked for main problems in the testing process, almost all interviewees indicate the poor quality of the requirements specification. In addition, asked for required input for different decisions, the interviewees indicate the requirements specification as an important input for almost all decisions. Finally, asked for a "wish list", the testers indicate that the quality of the requirements specification is more important than other sources of information. Based on these three facts, we conclude that the requirements specification is an important information source for testers. Nevertheless, organisations with a higher degree of test automation or which use more formal models (e.g. embedded area) may show different results.

7 Conclusions and Future Work

In this research work, we presented the results of an exploratory study performed during the SIKOSA project with experienced testers with the aim to analyze the information flow during testing as the starting point for test process improvements. This

work served as basis for the definition of the PAT3-Approach [IP06] as part of the whole SIKOSA methodology. The PAT3 Approach captures testing **experience and knowledge** in form of patterns. PAT3 defines five pattern categories (process patterns, automation patterns, transformation patterns, testability patterns, traceability patterns) which improve the interface between requirements engineering and testing.

The main results of our study regarding the research questions formulated in Section 3.1 can be summarized as follows:

The requirements specification is, not surprisingly, the document used most frequently during testing (Question 1). This document is used as input for all decisions to be made. However, there is another information source which is almost equally valuable: previously found defects. In addition, the requirements engineer and the project manager are roles consulted most frequently by testers (Question 2). Surprisingly, testers mention a high communication overhead during test execution. This fact is an indicator for poor quality of the requirements specification, confirmed as a major problem during testing by almost all interviewees. Experience plays an important role, and the definition of test data requires by far the most experience (Question 3). Moreover, decisions related to TP&C and TCE require much experience. At first glance, the latter is unexpected, but since most organizations do not define a test strategy, evaluation is not easy in the absence of operational goals. As expected, test execution requires little experience and is consequently well suited to be automated.

This exploratory study gives first indications for hypotheses we aim to verify in subsequent empirical studies. Based on our results, we can formulate the following hypotheses. **H1:** Previously found defects are good indicators and predictors for future defects. **H2:** Embedding the user into the testing process (particularly into the prioritization and reviewing the test cases) increases the efficiency of the testing process. **H3:** Testing decisions and activities require more system specific than general experience. **H4:** Combined approaches integrating experience into traditional test design techniques lead to better test cases.

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Annexes

Annex A: The Original Questionnaire in German

RUPRECHT–KARLS–UNIVERSITÄT HEIDELBERG
INSTITUT FÜR INFORMATIK – SOFTWARE ENGINEERING

Fragebogen zur Rolle Kommunikation, Dokumentation und der Erfahrung im Test

Eine qualitative empirische Studie

Motivation

Um Fehler zu finden, leitet ein Tester Testfälle aus unterschiedlichen Informationsquellen ab. Die Menge aller Informationen, die als Grundlage für die Ableitung von Testfällen dient, wird als Testbasis bezeichnet. Beim Systemtest dienen beispielsweise vor allem Anforderungen als Testbasis. Die Qualität der Testbasis ist entscheidend für die Güte der daraus ableitbaren Testfälle. Folglich ist es wichtig zu wissen, was Qualität aus Testersicht bedeutet, um diese bewerten und sicherstellen zu können. Dieser Fragebogen ist Teil einer qualitativen empirischen Studie, die an der Universität Heidelberg durchgeführt wird und in der folgende Fragestellungen adressiert werden sollen.

1. Welche Informationen werden für die Ableitung von Testfällen von Testern genutzt?
2. Wofür werden die Information genutzt?
3. Wann wird eine solche Information für den jeweiligen Zweck als "gut" bewertet?
4. Welche Rolle spielt die Erfahrung im Rahmen von Testaktivitäten?

So können Sie uns unterstützen:

- Interview: Sie füllen den beiliegenden Fragebogen aus, schicken diesen an uns zurück (Kontaktdaten finden Sie weiter unten). Auf dessen Grundlage führen wir ein kurzes (telefonisches) Interview durch. Das Beantworten des Fragebogens dauert ca. 30 Minuten, das Interview ca. 1 Stunde. Sollten Sie sich für diese Variante entscheiden, dann schicken Sie mir bitte Terminvorschläge in den Kalenderwochen 4-6, in denen wir das Interview durchführen können. Der ausgefüllte Fragebogen sollte dann ca. einen Tag vor dem Interview an uns zurückgesendet werden.
- Schriftlicher Fragebogen: Sie können uns bei dieser Studie unterstützen, in dem Sie „nur“ den nachfolgenden Fragebogen ausfüllen (Dauer ca. 30 Minuten). Sollten Sie sich für diese Variante entscheiden, dann schicken Sie bitte den beantworteten bis zum 31.01.2007 an uns zurück. Für Fragen bin ich telefonisch am 26.01 und am 31.01 telefonisch zwischen 10:00h – 18:00h erreichbar.

Struktur des Fragebogens

Der vorliegende Fragebogen gliedert sich in 3 Hauptbereiche:

Teil I: Allgemeines zu Ihrem Testhintergrund und zum Unternehmen
Teil II: Rolle der Dokumentation und Kommunikation bei der Durchführung von Testaktivitäten
Teil III: Rolle der Erfahrung bei der Durchführung von Testaktivitäten
Im Anhang finden Sie die Definition der wichtigsten Begriffe

Sollten Sie Fragen zum Fragebogen haben, bitte wenden Sie sich an:

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Wir bedanken uns für Ihre Mitarbeit!

Teil I: Allgemeine Fragen

Angaben zu Ihrem Testhintergrund

Branche

- ☐ kommerzieller Bereich – Banken, Versicherungen
- ☐ technischer Bereich – Maschinenbau, Chemie, Elektrotechnik, Telekommunikation, Transport
- ☐ öffentlicher Bereich – Verwaltung, Regierung
- ☐ Dienstleistung – Ausbildung, Beratung, IT-Dienstleistung
- ☐ Software Hersteller

Sonstiges, und zwar:

Aktuelle Position(en)

- ☐ Tester / Testingenieur
- ☐ Testmanager
- ☐ Testautomatisierer
- ☐ QS / QM Verantwortlicher
- ☐ Projektleiter / Projektmanager
- ☐ Produktmanager
- ☐ Anforderungsingenieur

Sonstiges, und zwar:

Testerfahrung

- ☐ keine
- ☐ 1-2 Jahre
- ☐ 3-5 Jahre
- ☐ 5-10 Jahre
- ☐ mehr als 10 Jahre

Geben Sie 3 der wichtigsten Aufgaben, die zu Ihrem Verantwortungsbereich gehören? (z.B. Testplanung, Spezifikation von Testfällen, usw.)

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Angaben zum Testprozess in Ihrem Unternehmen

Gibt es eine eigenständige Testabteilung?

☐ Ja
☐ Nein

Anzahl Mitarbeiter in einem typischen Projekt

- im Testbereich

  Gegen Sie hier bitte die Anzahl der Mitarbeiter eines typischen Projekts an, die Testaufgaben durchführen.

- im Entwicklungsbereich

  Gegen Sie hier bitte die Anzahl der Mitarbeiter eines typischen Projekts an, die weitere Rollen in einem typischen Projekt innehaben (z.B. Anforderungsingenieure, Architekten, usw.).

☐ Ich kann die Anzahl der Mitarbeiter / Projekt nicht angeben. Das Verhältnis zwischen MitarbeiterInnen im Test- und Entwicklungsbereich ist:

Welche Aktivitäten werden im Rahmen des Testprozesses durchgeführt? Von wem werden die jeweiligen Aktivitäten durchgeführt?

Aktivität des Testprozesses	**Rolle(n)** Z.B. Testmanager, Testingenieur, usw.
Testplanung und Steuerung	
☐ Zeitplanung	
☐ Ressourcenplanung	
☐ Aufwandsschätzung	
☐ Risiko-Analyse	
Definition der Teststrategie	
☐ Definition von Testendekriterien Z.B. 90% der Testfälle erfolgreich	
☐ Auswahl der Testentwurfstechnik Z.B. Grenzwertanalyse, usw.	
☐ Auswahl des Testmodells Z.B. Zustandsmodell	
☐ Auswahl der Testmodellrepräsentation Z.B. UML Zustandsdiagramm	
☐ Definition der Modellüberdeckungskriterien Z.B. Zustandsüberdeckung	
☐ Entscheidung über Automatisierungsgrad	
Testanalyse und Definition der Testfälle	

☐ Review der Anforderungen	
☐ Bewertung der Testbarkeit von Anforderungen	
☐ Definition von Testschritten	
☐ Definition von Testdaten	
☐ Definition der Testfallreihenfolge	
☐ Implementierung der Testfälle (falls Tests automatisiert werden)	
Testdurchführung und **Bewertung des Testlaufs**	
☐ Durchführung der Testfälle	
☐ Soll-/Ist-Vergleich	
☐ Testzyklusbewertung	
Sonstiges, und zwar:	

Welche sind die Hauptschwierigkeiten im Testprozess?

Testbarkeit von Anforderungen

☐ Geringer Formalisierungsgrad von Anforderungen

☐ Mangelnde Qualität von Anforderungen, Z.B. unvollständige oder inkonsistente Anforderungen

Schlechte Prozesskopplung zwischen Requirements Engineering (RE) und Test

☐ Kommunikationsproblem zwischen den Beteiligten beider Prozesse

☐ Kein/ unzureichend definierter Prozess zur Synchronisation von RE und Testaktivitäten

☐ Unzureichende Werkzeugunterstützung, vor allem für folgende Aktivitäten:

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Sonstige Probleme

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Teil II: Fragen zur Rolle der Dokumentation und Kommunikation bei der Durchführung von Testaktivitäten

Wichtige Informationsquellen für den Testprozess

Welche Dokumente/Artefakte verwenden Sie als Input/Grundlage für welche Aktivitäten(n) innerhalb des Testprozesses?

Gehen Sie bitte von einem typischen Projekt aus. Geben Sie bitte pro Artefakt an, ob dieses verwendet wird. Geben Sie weiterhin an, welche Dokumente in Ihrem Unternehmen sonst zum Einsatz kommen. In der letzten Spalte können Sie die Aktivitäten im Testprozess auflisten, die das jeweilige Artefakt als Input benötigen.

Artefakt	Dokument wird in einem typischen Projekt verwendet	Weitere Dokumente, die in Ihrem Unternehmen verwendet werden	Das Artefakt wird für folgende Aktivitäten(n) als Input verwendet Geben Sie hier diejenigen Aktivitäten an, die Sie während des Testprozesses durchführen (Frage 0)
Anforderungsspezifikation	☐	☐	
Architektur-/ Designbeschreibungen	☐	☐	
Quellcode	☐	☐	
Reviewprotokolle			
Anforderungsspezifikation	☐	☐	
Systemarchitektur	☐	☐	
Codereviews	☐	☐	
Sonstige Reviews, und zwar	☐	☐	
Fehlerprotokolle	☐	☐	
Problemmeldungen vom Kunden	☐	☐	
Benutzerdokumentation	☐	☐	
Sonstige Artefakte Geben Sie hier bitte Artefakte an, die in der obigen Auflistung nicht enthalten sind, die sie aber als Input für den Testprozess verwenden.			

	☐	☐	
	☐	☐	
	☐	☐	

Welche <u>Rollen/Personen</u> kontaktieren Sie um Informationen zu erhalten, die Sie bei durchzuführenden Aktivitäten des Testprozesses benötigen?

Gehen Sie bitte von einem typischen Projekt aus. Geben Sie bitte pro Rolle an, ob diese typischerweise kontaktiert wird. Geben Sie weiterhin an, welche weiteren Rollen in Ihrem Unternehmen sonst als Informationsgeber für den Testprozess kontaktiert werden. In der letzten Spalte können Sie die Aktivitäten im Testprozess auflisten, innerhalb derer die entsprechende Rolle kontaktiert wird.

Rolle	**Person/Rolle wird in einem typischen Projekt kontaktiert**	**Weitere Personen/ Rollen, die in Ihrem Unternehmen kontaktiert werden**	**Die Rolle/Person liefert Input / Informationen für folgende Aufgabe(n)** Geben Sie hier diejenigen Aktivitäten an, die Sie während des Testprozesses durchführen (Frage 0)
Anforderungsingenieur	☐	☐	
Marketing	☐	☐	
Benutzer	☐	☐	
Kunden	☐	☐	
Projektleiter	☐	☐	
Produktmanager	☐	☐	
Architekt / Designer	☐	☐	
Programmierer	☐	☐	
Sonstige Rolle(n) Geben Sie hier bitte Personen/Rolle(n) an, die in der obigen Auflistung nicht enthalten sind.			
	☐	☐	
	☐	☐	
	☐	☐	

Welche weiteren Informationsquellen verwenden Sie innerhalb des Testprozesses?

Informationsquelle	Informations-quelle wird in einem typischen Projekt verwendet	Weitere Informations-quellen, die in Ihrem Unternehmen verwendet werden	Die Informationsquelle wird für folgende Aufgabe(n) als Input verwendet Geben Sie hier diejenigen Aktivitäten an, die Sie während des Testprozesses durchführen (Frage 0)
Vorgängerversionen der zu testenden Software	☐	☐	
Ähnliche Systeme	☐	☐	
Konkurrenzprodukt	☐	☐	
Besprechungsnotizen, Gesprächsprotokolle, Emails	☐	☐	
Eigene Erfahrung	☐	☐	
Eigene Fehlerlisten	☐	☐	
Publizierte Fehlerlisten	☐	☐	
Sonstige Informationsquellen	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	
	☐	☐	

Welche weiteren Informationsquellen würden Sie verwenden, falls diese verfügbar wären? Geben Sie bitte auch an, für welche Aufgaben Sie diese verwenden würden und warum diese Quellen Ihrer Meinung nach nicht verfügbar sind!

„Wunsch“-Informationsquelle	Die Informationsquelle würde ich für folgende **Aufgabe(n)** als Input verwenden ...	Die Informationsquelle ist nicht verfügbar, weil ...

Wie dokumentieren Sie Testfälle?

☐ Anforderungen werden als System-Testfälle verwendet

☐ Anforderungen werden erweitert und dienen so als Testfälle. Folgende Informationen werden hinzugefügt, um aus Anforderungen System-Testfälle zu erhalten:

☐ Eine Stichwortliste genügt, die Tester entwickeln auf deren Basis Testfälle

während des Testens.

☐ Testfälle werden aus Anforderungen abgeleitet uns ausführlich z.B. als Testszenarien spezifiziert. Die Spezifikation eines Testfalls enthält folgende Angaben:

☐ Tests werden erst nach der Durchführung innerhalb von Testprotokollen dokumentiert

☐ Wir verwenden grafische Darstellungen, z.B. Datenflussmodell
und zwar:

☐ Sonstiges, und zwar:

Anforderungen als Input für den Testprozess: Allgemeine Eigenschaften

Bitte geben Sie die 5 wichtigsten Eigenschaften, die Anforderungen haben müssen, um als Input für Testaktivitäten verwendet zu werden?

- ☐ vollständig
- ☐ korrekt
- ☐ klassifizierbar
- ☐ prüfbar
- ☐ eindeutig
- ☐ verständlich
- ☐ aktuell
- ☐ realisierbar
- ☐ verfügbar
- ☐ priorisiert

Sonstiges:

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Bitte begründen Sie Ihre Entscheidung! Gehen Sie vom Schaden bzw. von den negativen Konsequenzen für den Test aus, die durch das Nichterfülltsein einer Eigenschaft entsteht.

Angegebene Eigenschaft einer Anforderung aus Frage 0	Negative Konsequenzen für den Test, falls diese Eigenschaft nicht erfüllt ist.

Geben Sie für die 5 wichtigsten Eigenschaften aus Frage 0 an, wann diese aus Testsicht erfüllt sind!

Beispiel: Anforderungen sind verfügbar, wenn: alle Tester Zugriff auf die relevanten Informationen haben.

- Anforderungen sind , wenn: .
- Anforderungen sind , wenn: .
- Anforderungen sind , wenn: .
- Anforderungen sind , wenn: .
- Anforderungen sind , wenn: .

Geben Sie für die 5 wichtigsten Eigenschaften aus Frage 0 an, welche Maßnahmen sie ergreifen, wenn diese aus Testsicht nicht erfüllt sind!

Wichtige Eigenschaft einer Anforderung aus Frage 0	Maßnahmen, die Sie ergreifen, falls Eigenschaft nicht erfüllt ist

Wichtige Eigenschaft einer Anforderung aus Frage 0	Maßnahmen, die Sie ergreifen, falls Eigenschaft nicht erfüllt ist

Anforderungen als Input für den Testprozess: Detaillierte Analyse

Welche Angaben sind zu einer Anforderung typischerweise dokumentiert?

Geben Sie bitte an, aus welchen Entitäten eine Anforderungsspezifikation typischerweise besteht.

- ☐ Bezeichnung/Name
- ☐ Ziel
- ☐ Beschreibung
- ☐ Eingangsdaten
- ☐ Ausgangsdaten
- ☐ Ausnahmefälle
- ☐ Regeln
- ☐ Verantwortliche Rolle(n)
- ☐ Beteiligte Rolle(n)
- ☐ Systemschritte
- ☐ Aktorschritte
- ☐ Vorbedingung(en)
- ☐ Nachbedingung(en)
- ☐ Qualitätsanforderungen
- ☐ Priorität
- ☐ Häufigkeit
- ☐ Abhängigkeiten zu weiteren Anforderungen

Sonstiges, und zwar

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Welche Informationen (Entitäten) aus der Anforderungsspezifikation verwenden Sie als Input für die Durchführung von Testaktivitäten?

Bitte geben Sie pro Aktivität an, welche Entitäten der Anforderungsspezifikation als Input für Testaktivitäten dienen. Falls sie keine Informationen aus der Anforderungsspezifikation für die jeweilige Aktivität benötigen, geben Sie bitte „kein Input“ oder ähnliches ein.

Aktivität des Testprozesses	Input aus der Anforderungsspezifikation Z.B. Ausnahmefälle, Priorität, usw..
Testplanung und Steuerung	
☐ Zeitplanung	
☐ Ressourcenplanung	
☐ Aufwandsschätzung	
☐ Risiko-Analyse	
Definition der Teststrategie	
☐ Definition von Testendekriterien Z.B. 90% der Testfälle erfolgreich	
☐ Auswahl der Testentwurfstechnik Z.B. Grenzwertanalyse, usw.	

Aktivität des Testprozesses	**Input aus der Anforderungsspezifikation** Z.B. Ausnahmefälle, Priorität, usw..
☐ Auswahl des Testmodells Z.B. Zustandsmodell	
☐ Auswahl der Testmodellrepräsentation Z.B. UML Zustandsdiagramm	
☐ Definition der Modellüberdeckungskriterien Z.B. Zustandsüberdeckung	
☐ Entscheidung über Automatisierungsgrad	
Testanalyse und Definition der Testfälle	
☐ Review der Anforderungen	
☐ Bewertung der Testbarkeit von Anforderungen	
☐ Definition von Testschritten	
☐ Definition von Testdaten	
☐ Definition der Testfallreihenfolge	
☐ Implementierung der Testfälle (falls Tests automatisiert werden)	
Testdurchführung und Bewertung des Testlaufs	
☐ Durchführung der Testfälle	
☐ Soll-/Ist-Vergleich	
☐ Testzyklusbewertung	
Sonstiges, und zwar:	

Wie müssen Anforderungen beschaffen sein, damit Sie Aufgaben der Testplanung und Steuerung effizient durchführen können?

Bitte geben Sie hier die max. 5 wichtigsten Eigenschaften an.

Qualitätskriterien

☐ vollständig ☐ korrekt ☐ klassifizierbar
☐ konsistent ☐ prüfbar ☐ eindeutig
☐ verständlich ☐ aktuell ☐ realisierbar
☐ verfügbar ☐ priorisiert

Weitere Kriterien:
(Geben Sie hier bitte ggf. weitere, in der obigen Auflistung nicht aufgeführte Kriterien an!)

Formalisierungsgrad:
☐ formal (z.B. in einer formalen Spezifikationssprache wie Z, aber auch Quellcode)
☐ Semi-formal (z.B. UML)
☐ Strukturiert (z.B. in Form von Templates)
☐ nartürlichsprachlich
☐ egal
Sonstiges:

Notation: (z.B. Sequenzdiagramme, Liste, usw.)

Wie müssen Anforderungen beschaffen sein, damit die Teststrategie effizient definiert werden kann?

Bitte geben Sie hier die max. 5 wichtigsten Eigenschaften an.

Qualitätskriterien

☐ vollständig ☐ korrekt ☐ klassifizierbar
☐ konsistent ☐ prüfbar ☐ eindeutig
☐ verständlich ☐ aktuell ☐ realisierbar
☐ verfügbar ☐ priorisiert

Weitere Kriterien:

(Geben Sie hier bitte ggf. weitere, in der obigen Auflistung nicht aufgeführte Kriterien an!)

Formalisierungsgrad:

☐ formal (z.B. in einer formalen Spezifikationssprache wie Z, aber auch Quellcode)
☐ Semi-formal (z.B. UML)
☐ Strukturiert (z.B. in Form von Templates)
☐ nartürlichsprachlich
☐ egal
Sonstiges:

Notation: (z.B. Sequenzdiagramme, Liste, usw.)

Wie müssen Anforderungen beschaffen sein, damit Testfälle effizient aus Anforderungen abgeleitet werden können?

Bitte geben Sie hier die max. 5 wichtigsten Eigenschaften an.

Qualitätskriterien

☐ vollständig ☐ korrekt ☐ klassifizierbar
☐ konsistent ☐ prüfbar ☐ eindeutig
☐ verständlich ☐ aktuell ☐ realisierbar
☐ verfügbar ☐ priorisiert

Weitere Kriterien:

(Geben Sie hier bitte ggf. weitere, in der obigen Auflistung nicht aufgeführte Kriterien an!)

Formalisierungsgrad:

☐ formal (z.B. in einer formalen Spezifikationssprache wie Z, aber auch Quellcode)
☐ Semi-formal (z.B. UML)
☐ Strukturiert (z.B. in Form von Templates)
☐ nartürlichsprachlich
☐ egal
Sonstiges:

Notation: (z.B. Sequenzdiagramme, Liste, usw.)

Wie müssen Anforderungen beschaffen sein, damit ein Testlauf effizient ausgewertet werden kann?

Bitte geben Sie hier die max. 5 wichtigsten Eigenschaften an.

Qualitätskriterien

☐ vollständig ☐ korrekt ☐ klassifizierbar
☐ konsistent ☐ prüfbar ☐ eindeutig
☐ verständlich ☐ aktuell ☐ realisierbar
☐ verfügbar ☐ priorisiert

Weitere Kriterien:

(Geben Sie hier bitte ggf. weitere, in der obigen Auflistung nicht aufgeführte Kriterien an!)

Formalisierungsgrad:

☐ formal (z.B. in einer formalen Spezifikationssprache wie Z, aber auch Quellcode)
☐ Semi-formal (z.B. UML)
☐ Strukturiert (z.B. in Form von Templates)
☐ nartürlichsprachlich
☐ egal
Sonstiges:

Notation: (z.B. Sequenzdiagramme, Liste, usw.)

Teil III: Rolle der Erfahrung bei der Durchführung von Testaktivitäten

Welche Rolle spielt Erfahrung bei der Durchführung von Testaktivitäten?

Geben Sie bitte pro Aktivitäten an, wie stark die Ergebnisse dieser Aktivität von Erfahrungswerten abhängig sind. Falls Sie die entsprechende Aktivität nicht durchführen, kreuzen Sie bitte nichts an! Geben Sie bitte ebenfall an, ob es sich um Erfahrungen zum gleichen System oder um allgemeine Erfahrungen (z.B. aus vergangenen Projekten) handelt.

Aktivitäten	Wie stark sind die Ergebnisse der jeweiligen Aktivität von Erfahrungswerten abhängig?			Erfahrungsquelle	
	stark	kaum	gar nicht	Erfahrung zum gleichen System	allg. Erfahrungen
Testplanung und Steuerung					
Zeitplanung	☐	☐	☐	☐	☐
Ressourcenplanung	☐	☐	☐	☐	☐
Aufwandsschätzung	☐	☐	☐	☐	☐
Risikoanalyse	☐	☐	☐	☐	☐
Definition der Teststrategie					
Definition von Testendekriterien Z.B. 90% der Testfälle erfolgreich	☐	☐	☐	☐	☐
Auswahl der Testentwurfstechnik Z.B. Grenzwertanalyse, usw.	☐	☐	☐	☐	☐
Auswahl des Testmodells Z.B. Zustandsmodell	☐	☐	☐	☐	☐
Auswahl der Testmodellrepräsentation Z.B. UML Zustandsdiagramm	☐	☐	☐	☐	☐
Definition der Modellüberdeckungskriterien Z.B. Zustandsüberdeckung	☐	☐	☐	☐	☐
Entscheidung über Automatisierungsgrad des Testens	☐	☐	☐	☐	☐

Aktivitäten	Wie stark sind die Ergebnisse der jeweiligen Aktivität von Erfahrungswerten abhängig?			Erfahrungsquelle	
	stark	kaum	gar nicht	Erfahrung zum gleichen System	allg. Erfahrungen
Testanalyse und Definition der Testfälle					
Review der Anforderungen	◐	◐	◐	☐	☐
Bewertung der Testbarkeit von Anforderungen	◐	◐	◐	☐	☐
Definition von Testschritten	◐	◐	◐	☐	☐
Definition von Testdaten	◐	◐	◐	☐	☐
Definition der Testfallreihenfolge	◐	◐	◐	☐	☐
Implementierung der Testfälle (falls Tests automatisiert werden)	◐	◐	◐	☐	☐
Testdurchführung und Bewertung des Testlaufs					
Durchführung der Testfälle	◐	◐	◐	☐	☐
Soll-Ist Vergleich	◐	◐	◐	☐	☐
Testzyklusbewertung	◐	◐	◐	☐	☐
Sonstige Aktivitäten					
	◐	◐		☐	☐
	◐	◐		☐	☐
	◐	◐		☐	☐
	◐	◐		☐	☐
	◐	◐		☐	☐

Auf welche Erfahrung können Sie im Rahmen von Testaktivitäten zurückgreifen?

Bitte kreuzen Sie Zutreffendes an! Erfahrung verstehen wir im Rahmen dieses Fragebogens als die Gesamtheit aller selbst erworbenen Kenntnisse und Fertigkeiten basierend auf Wahrnehmungen, Erlebnissen und kognitiven Prozessen aus vergangenen Projekten.

Rolle der „Entstehungsgeschichte“ einer Anforderung im Rahmen von Testaktivitäten.

☐ Ich weiß, wenn manche Anforderungen sehr oft bis zur Freigabe geändert wurden.

Diese Information verwenden wir, um

(z.B. die Testintensität für die entsprechenden Anforderungen zu bestimmen. Bitte geben Sie an, wofür sie die Information über die Entstehung einer Anforderung im Rahmen von Testaktivitäten verwenden!)

☐ Ich weiß, wenn manche Anforderungen sehr spät hinzukommen.

Diese Information verwenden wir, um

(z.B. die Testintensität für die entsprechenden Anforderungen zu bestimmen. Bitte geben Sie an, wofür sie die Information über die Entstehung einer Anforderung im Rahmen von Testaktivitäten verwenden!)

☐ Ich weiß, wenn manche Anforderungen sich sehr spät ändern.

Diese Information verwenden wir, um

(z.B. die Testintensität für die entsprechenden Anforderungen zu bestimmen. Bitte geben Sie an, wofür sie die Information über die Entstehung einer Anforderung im Rahmen von Testaktivitäten verwenden!)

☐ Ich beziehe Review-Protokolle für Anforderungen im Rahmen von Testaktivitäten ein.

Hierbei interessiert mich / interessieren mich vor allem folgende Information(en):

(z.B. Kritische Fehler, Anzahl kritischer Fehler, usw.)

Diese Information verwenden wir, um

(z.B. die Testintensität für die entsprechenden Anforderungen zu bestimmen. Bitte geben Sie an, wofür sie die Information über die Entstehung einer Anforderung im Rahmen von Testaktivitäten verwenden!)

☐ Ich nehme an Review-Sitzungen für Anforderungen teil. Folgende Fehlertypen stufe ich als „kritisch“ ein.

(z.B. widersprüchliche Anforderungen, unverständliche Anforderungen, usw...)

Rolle der bisher bekannten Fehler im Rahmen von Testaktivitäten.

☐ Ich kenne die Fehler aus Vergangenheit. Diese Information wird verwendet, um

(z.B. an „bekannten“ Stellen noch intensiver zu testen. Bitte geben Sie an, wofür sie Informationen über Modulgröße im Rahmen von Testaktivitäten verwenden!)

☐ Ich kenne die Fehler, die erst beim Kunden entdeckt wurden. Diese Information wird verwendet, um

(z.B. an „bekannten“ Stellen noch intensiver zu testen. Bitte geben Sie an, wofür sie Informationen über Modulgröße im Rahmen von Testaktivitäten verwenden!)

☐ Ich nehme an Freigabe-Sitzungen für Systemreleases teil.
Hierbei interessiert mich / interessieren mich vor allem folgende Information(en):

Diese Information verwenden wir, um

☐ Im Rahmen von Testaktivitäten wird die Fehlerdichte in den einzelnen Modulen überwacht. Diese Information wird verwendet, um

(z.B. um zu entscheiden, ob Testaktivitäten abgebrochen werden können. Bitte geben Sie an, wofür sie Informationen über Modulgröße im Rahmen von Testaktivitäten verwenden!)

Rolle des Quellcodes im Rahmen von Testaktivitäten.

☐ Wir erheben Komplexitätsmetriken. Diese Information wird verwendet, um

(z.B. die Testintensität zu bestimmen. Bitte geben Sie an, wofür sie Komplexitätsmetriken im Rahmen von Testaktivitäten verwenden!)

☐ Im Rahmen von Testaktivitäten wird die Modulgröße betrachtet. Diese Information wird verwendet, um

(z.B. die Testintensität zu bestimmen. Bitte geben Sie an, wofür sie Informationen über Modulgröße im Rahmen von Testaktivitäten verwenden!)

☐ Im Rahmen von Testaktivitäten wird der Bearbeitungsstatus eines Moduls (neu, geändert, unverändert gegenüber Vorversion) betrachtet. Diese Information wird verwendet, um

(z.B. die Testintensität zu bestimmen. Bitte geben Sie an, wofür sie Informationen über den Bearbeitungsstatus eines Moduls im Rahmen von Testaktivitäten verwenden!)

✍ **Welche sonstigen Erfahrungen sind Ihnen von Nutzen im Rahmen von Testaktivitäten? In welchem Kontext werden diese Verwendet?**

Erfahrung	... wird verwendet, um

Vielen Dank für die Beantwortung der Fragen!

ANHANG: Glossar

Nachfolgend werden die wichtigsten Begriffe, die im Fragebogen verwendet werden, kurz erläutert.

Aktivität	Oberbegriff für alle Arbeitseinheiten, von der einzelnen Aufgabe bis hin zum gesamten Projekt. **Synonyme** Aufgabe, Tätigkeit
Anforderung	(1) Eigenschaft oder Fähigkeit, die von einem Anwender zur Lösung eines Problems oder zur Erreichung eines Ziels benötigt wird, (2) Eigenschaft oder Fähigkeit, die eine Software erfüllen oder besitzen muss, um einen Vertrag, eine Norm oder ein anderes, formell bestimmtes Dokument zu erfüllen. [nach IEEE 610]
Erfahrung	Erfahrung verstehen wir im Rahmen dieses Fragebogens als die Gesamtheit aller selbst erworbenen Kenntnisse und Fertigkeiten basierend auf Wahrnehmungen, Erlebnissen und kognitiven Prozessen aus vergangenen Projekten.
Metrik	(1) Eine Messskala und eine Methode, die für Messungen verwendet wird. [ISO 14598] (2) Größe zur Messung einer bestimmten Eigenschaft eines Programms oder einer Komponente. Die Durchführung der Messung ist Aufgabe der statischen Analyse. **Beispiel** für eine Code Metrik ist die Anzahl der Code Zeilen. **Siehe auch** Testmetrik
Review	Die Bewertung eines Software-Produkts oder eines Projektstatus zur Aufdeckung von Diskrepanzen der geplanten Arbeitsergebnisse und der Identifizierung von Verbesserungspotenzialen. Review ist ein Oberbegriff für Management Review, informelles Review, Technisches Review, Inspektion und Walkthrough. [nach IEEE 1028]
Risiko	Ein Faktor, der zu negativen Konsequenzen in der Zukunft führen könnte; gewöhnlich ausgedrückt durch die Eintrittswahrscheinlichkeit und den Schadensausmaß. **Siehe auch** Risiko-Analyse
Risiko-Analyse	Prozess zur systematischen Identifizierung der Risiken in einem Projekt. Die Beurteilung der

	Risiken beeinflusst die Auswahl der in einem Projekt oder in einer Phase durchzuführenden Aktivitäten.
Testendekriterium	Die Menge der abgestimmten generischen und spezifischen Bedingungen, die von allen Beteiligten für den Abschluss eines Prozesses akzeptiert wurden. Durch Festlegung von Ausgangsbedingungen für eine Aufgabe wird vermieden, dass eine Aufgabe als abgeschlossen betrachtet wird, auch wenn Teile der Aufgabe noch nicht abgeschlossen sind.
Testentwurfstechnik	(1) Planmäßiges, auf einem Regelwerk aufbauendes Vorgehen zur Herleitung und/oder zur Auswahl von Testfällen (2) Das Vorgehen (z.B. manuell, Einsatz eines Mitschnittwerkzeugs, ...) bei der Durchführung von Tests. **Beispiele** sind Äquivalenzklassenanalyse, Grenzwertanalyse, usw. **Synonyme** Testverfahren, Testmethode
Traceability	Als Traceability bezeichnet man die Möglichkeit, Zusammenhänge zwischen Anforderungen und Tests zu identifizieren. **Synonyme** Rückverfolgbarkeit, Nachvollziehbarkeit
Fehler	(1) Inkorrektes Teilprogramm, inkorrekte Anweisung oder Datendefinition, die Ursache für einen äußeren Fehler ist. (2) Zustand eines (Software)Produkts oder einer seiner Komponenten, der unter spezifischen Bedingungen (z.B. bei einer hohen Belastung) eine geforderte Funktion des Produkts beeinträchtigen kann bzw. zu einer Fehlerwirkung führt (z.B. inkorrekte Anweisung oder Datendefinition). (3) Nichterfüllung einer festgelegten Anforderung. (4) Oberbegriff für Fehlhandlung, Fehlerzustand, Fehlerwirkung. **Synonyme** Abweichung

Annex B: The English Translation of the Questionnaire

RUPRECHT–KARLS–UNIVERSITÄT HEIDELBERG
INSTITUT FÜR INFORMATIK – SOFTWARE ENGINEERING

Survey about the Role of Communication, Documentation and Experience during Testing

A qualitative empirical study

Motivation

A tester derives test cases from different information sources in order to to detect defects.The set of test cases that serves as a basis for the derivation of test cases is called a test basis. During the system testing the requirements specification, for example, represents the test basis. The quality of the test basis is essential for the quality of the derived test cases. Consequently, it is salient to know what, from a tester's point of view, quality means, which enables to assure and to control it. This questionnaire is a part of the qualitative empirical study performed at the University of Heidelberg. The following research questions are raised:

1. What kind of information is used when testers derive test cases?
2. For what purpose is this information used?
3. When such information is estimated as "good"?
4. What role does experience play during testing?

You can support us in the following ways:

- Interview: You are to fill in this questionnaire and send it back to us. (Contact information is to be find below). Then, based on the filled questionnaire, you will be interviewed (per telephone). It takes about 30 minutes to fill in the questionnaire, the interviewing will take appr. 1 hour. If you choose this variant, please send me (during 4-6 calender weeks) the possible appointment dates for the interviewing. The filled in questionnaire should be sent back to us appr. 1 day before the interviewing
- Written Questionnaire: You can also support us by filling in the following questionnaire (takes about 30 minutes). If you prefer this variant, please send the filled in questionnaire back to us by 31.01.2007.

For further information you can contact me per telephone on 26.01 and on 31.01 between 10:00h-18:00h.

Structure of the questionnaire

The questionnaire is divided into three main parts:
Part I - General information on your background and your organization
Part II - The role of documentation and communication during testing
Part III - The role of experience during testing

If you have any questions to the questionnaire please contact:
Timea Illes-Seifert
Universität Heidelberg, Institut für Informatik
Telefon +49 (0) 6221 / 54 - 5817
Fax +49 (0) 6221 / 54 - 5813
Email illes-seifert@informatik.uni-heidelberg.de

Thank you for your support!

Part I: General Questions

Information on your professional background

Line of business

- ☐ commercial sector – banking, insurance
- ☐ technical sector – machine construction, chemical industry, electrical engineering, telecommunications, transport
- ☐ public domain – administration, government
- ☐ service – education, consulting, it service
- ☐ software vendor

others:

Current position(s)

- ☐ tester / test engineer
- ☐ test manager
- ☐ test automator
- ☐ QA / QM
- ☐ project manager
- ☐ product manager
- ☐ requirements engineer

others:

Testing experience

- ☐ no experiencs
- ☐ 1-2 years
- ☐ 3-5 years
- ☐ 5-10 years
- ☐ more than 10 years

Please indicate 3 most important tasks in your area of responsibility (e.g test planning, test case specification, …

-
-
-

Information on the testing process in your organization

Is there any independent testing group in your organization?

- ☐ Yes
- ☐ No

Number of employees in a typical project

- testing

  Please indicate the number of employees in a typical project which accomplish testing tasks here.

- development

  Please indicate the number of employees in a typical project which hold other roles than testing (e.g. requirements engineers, system designers, ...) here

☐ I do not know the number of employees per project. The ration of employees in testing and in development is:

Which activities are perfomed during the testing process? Who does perform the corresponding activities?

Activity of the testing process	Role(s) e.g. testmanager, test engineer,...
Test planning and control	
☐ scheduling	
☐ ressource planning	
☐ cost estimation	
☐ risk analysis	
Test strategy definition	
☐ Definition of test end criteria E.g. 90% of the test cases passed	
☐ Selection of a test design technique E.g. boundary value analysis	
☐ Selection of a test model E.g. state model	
☐ Selection of a model representation E.g. UML state model	
☐ Definition of model coverage criteria E.g. state coverage	
☐ Decision on the automation degree	
Test analysis and design	
☐ Review of the requirements	
☐ Decision on the testability of the requirements	
☐ Definition of test Steps	
☐ Definition of test data	
☐ Definition of test sequences	
☐ Realization of the test cases (in case of test automation)	
Test execution and test cycle evaluation	
☐ Test case execution	
☐ Test case evaluation	

☐ Test cycle evaluation	
others	

Which are the most severe issues in testing?

Testability of requirements

☐ Little formalization of the requirements

☐ Poor quality of the requirements, e.g. incomplete or inconsistent requirements

Poor process interface between Requirements Engineering (RE) and Testing

☐ Communication issues among the participants of both processes

☐ Not defined/ inadequate process fort he synchronisation of RE und Testing activities

☐ Inadequate tool support, above all for the following activities:

-
-
-

Other Problems

-
-
-

Part II: The role of documentation and communication during testing

Important information sources for the testing process

Which documents / artifacts are used as input for which activities during the testing process?

Assume a typical project. Please indicate per document whether this particular document is used. In addition, please indicate other documents used in your organization. In the last column, please indicate the activities of the testing process that take the corresponding artifact as input.

Document / Artifakt	Document used in a typical project	Document used within the organization	Document used for the following activities
Requirements specification	☐	☐	
Architecture / design specification	☐	☐	
Code	☐	☐	
Review protocols			
Requirements specification	☐	☐	
System architecture/design	☐	☐	
Code reviews	☐	☐	
Other Reviews	☐	☐	
Defect reports	☐	☐	
Problem reports from the custormer	☐	☐	
User manuals	☐	☐	
Other documents Please indicate documents, not included in the list above, which are used during the testing process.			
	☐	☐	
	☐	☐	
	☐	☐	

Which roles do you contact in order to get information needed to perform activities of the testing process?

Please assume a typical project. Please indicate for each role whether this particular role is usually contacted. In addition, please indicate which other roles in your organization are valuable sources of information fort the testing process. In the last column, please indicate the activities of the testing process during which the corresponding role is inquired.

Role	Role which is contancted in a typical project	Further roles in the organization which are usually contacted	The role delivers information needed for the following activities of the testing process
Requirements engineer	☐	☐	
Marketing	☐	☐	
User	☐	☐	
Customer	☐	☐	
Project manager	☐	☐	
Product manager	☐	☐	
Architect / Designer	☐	☐	
Developer	☐	☐	
Other role(s) Please indicate roles not contained in the list above.			
	☐	☐	
	☐	☐	
	☐	☐	

What other information sources do you use during the testing process?

Source of information	Source of information used in a typical project	Further sources of information used in the organization	The source of information needed for the following activities in the testing process
Previous version of the software under test	☐	☐	
Similar software products	☐	☐	
Competitor's product	☐	☐	
Meeting notes, Emails	☐	☐	
Own experience	☐	☐	
Own defect lists	☐	☐	
Published defect lists	☐	☐	
Other sources of information	☐	☐	

Source of information	Source of information used in a typical project	Further sources of information used in the organization	The source of information needed for the following activities in the testing process
	☐	☐	
	☐	☐	
	☐	☐	

Which other sources of information would you use if they were available? Please indicate for which tasks you would use these sources of information and why they are not available!

„Wish"-Information	I would use this source of information as input for the following tasks.	The source of information is not available because ...

How are test cases documented?

☐ The reqruirements are used as test cases

☐ The requirements are extended and serve as test cases. The following information is added in order to obtain test cases based on requirements:

Anforderungen werden erweitert und dienen so als Tfälle. Folgende

☐ A keyword list is enough, the testers develop test cases based on this list during test execution.

☐ Test cases are derived from requirements and are specified in detail, for example as test scenarios. The test specification contains the following information:

☐ Test cases are documented only after test execution in test protocols

☐ We use a grafical representation for the test case specification, namely

☐ Others, namely:

Requirements as input for the testing process: General Characteristics

Please indicate 5 most important characteristics requirement specification has to posses in order to be suitable as input for testing tasks.

- ☐ complete
- ☐ correct
- ☐ classifiable
- ☐ testable
- ☐ unanbiguous
- ☐ understandable
- ☐ up-to-date
- ☐ realizable
- ☐ available
- ☐ prioritized

others:

-
-
-

Please justify your decision! Please estimate the damage resp. the negative consequences when the corresponding characteristic is not fulfilled.

Characteristic (from the question above)	Negative consequences for the test case when this characteristic is not fulfilled

Please indicate cases in which these 5 most important characteristics are fulfilled from a tester's point of view!

Example: Requirements are available if all testers have access to the relevant information.

- Requirements are if: .
- Requirements are if: .
- Requirements are if: .
- Requirements are if: .
- Requirements are if: .

Please indicate what measures you take if these 5 most important characteristics are not fulfilled from the tester's point of view.

Characteristic (from the question above)	Measures you take in the case that the characteristic is not fulfilled

Requirements as input for the testing process: Detailed analysis

Which information is documented for each requirement?

Please indicate information which can be specified to a requirement

- ☐ Name
- ☐ Ziel
- ☐ Description
- ☐ Input data
- ☐ Output data
- ☐ Exceptions
- ☐ Rules
- ☐ Responsible Role(s)
- ☐ Participating Role(s)
- ☐ Syste steps
- ☐ Actor steps
- ☐ Preconditions
- ☐ Postconditions
- ☐ Quality requirements
- ☐ Priority
- ☐ Frequency
- ☐ Dependencies to other requirements

Others, namely

- •
- •
- •
- •

What information (entities) of the requirements specification is used as an input for testing activities?

Please indicate (per activity) which entities of the requirements specification are used as input for testing activities.

Activity of the testing process	Input from the requirements specification E.g. exceptions, priority, etc..
Test planning and control	
☐ scheduling	
☐ ressource planning	
☐ cost estimation	
☐ risk analysis	
Test strategy definition	
☐ Definition of test end criteria E.g. 90% of the test cases passed	
☐ Selection of a test design technique E.g. boundary value analysis	
☐ Selection of a test model E.g. state model	
☐ Selection of a model representation E.g. UML state model	
☐ Definition of model coverage criteria E.g. state coverage	
☐ Decision on the automation degree	
Test analysis and design	
☐ Review of the requirements	

Activity of the testing process	**Input from the requirements specification** E.g. exceptions, priority, etc..
☐ Decision on the testability of the requirements	
☐ Definition of test Steps	
☐ Definition of test data	
☐ Definition of test sequences	
☐ Realization of the test cases (in case of test automation)	
Test execution and test cycle evaluation	
☐ Test case execution	
☐ Test case evaluation	
☐ Test cycle evaluation	
others	

Which characteristics must fulfill the requirements in order to enable the efficient execution of test planning and control activities?

Please indicate 5 most important characteristics.

Quality criteria

☐ complete	☐ correkt	☐ classifiable
☐ consistent	☐ testable	☐ unanbiguous
☐ understandable	☐ up-to-date	☐ realizable
☐ available	☐ prioritized	

Other criteria:

(Please indicate other criteria not contained in the list above.)

Formality:

☐ formal (e.g. formal specification language such as Z but also code)
☐ Semi-formal (e.g. UML)
☐ Structured (e.g. as templates)
☐ natural language
☐ it does not matter

others:

Notation: (e.g. sequence diagrams, lists, etc...)

Which characteristics must fulfill the requirements in order to enable the efficient execution of test strategy definition activities?

Please indicate 5 most important characteristics.

Quality criteria

☐ complete	☐ correkt	☐ classifiable
☐ consistent	☐ testable	☐ unanbiguous
☐ understandable	☐ up-to-date	☐ realizable
☐ available	☐ prioritized	

Other criteria:

(Please indicate other criteria not contained in the list above here.)

Formality:

☐ formal (e.g. formal specification language such as Z but also code)
☐ Semi-formal (e.g. UML)
☐ Structured (e.g. as templates)
☐ natural language
☐ it does not matter

others:

Notation**:** (e.g. sequence diagrams, lists, etc...)

Which characteristics must fulfill the requirements in order to enable the efficient derivation of test cases from requirements?

Please indicate the most important 5 characteristics.

Quality criteria

☐ complete	☐ correkt	☐ classifiable
☐ consistent	☐ testable	☐ unanbiguous
☐ understandable	☐ up-to-date	☐ realizable
☐ available	☐ prioritized	

Other criteria:

(Please indicate other criteria not contained in the list above here.)

Formality:

☐ formal (e.g. formal specification language such as Z but also code)
☐ Semi-formal (e.g. UML)
☐ Structured (e.g. as templates)
☐ natural language
☐ it does not matter

others:

Notation**:** (e.g. sequence diagrams, lists, etc...)

Which characteristics must fulfill the requirements in order to enable the efficient test execution and test cycle evaluation?

Please indicate 5 most important characteristics.

Quality criteria

☐ complete	☐ correkt	☐ classifiable
☐ consistent	☐ testable	☐ unanbiguous
☐ understandable	☐ up-to-date	☐ realizable
☐ available	☐ prioritized	

Other criteria:

(Please indicate other criteria not contained in the list above here.)

Formality:

☐ formal (e.g. formal specification language such as Z but also code)
☐ Semi-formal (e.g. UML)
☐ Structured (e.g. as templates)
☐ natural language
☐ it does not matter

others:

Notation**:** (e.g. sequence diagrams, lists, etc...)

Part III: The Role of Experience for Testing

What role does experience play for the execution of testing activities?

Please indicate for each activity to what extent the results of the particular activity depend on the testers' experience, executing it. In the case the particular activity is not performed, please do not check anything. Please indicate whether general experience (experience from other projects) or test specific experience is needed for the corresponding activity.

Activity	To what extent does the activity depend on testers' experience?			Source of experience	
	highly	mar-ginal	not at all	Experience with the same system	general experience
Test planning and control					
scheduling	☐	☐	☐	☐	☐
ressource planning	☐	☐	☐	☐	☐
cost estimation	☐	☐	☐	☐	☐
risk analysis	☐	☐	☐	☐	☐
Test strategy definition					
Definition of test end criteria E.g. 90% of the test cases passed	☐	☐	☐	☐	☐
Selection of a test design technique E.g. boundary value analysis	☐	☐	☐	☐	☐
Selection of a test model E.g. state model	☐	☐	☐	☐	☐
Selection of a model representation E.g. UML state model	☐	☐	☐	☐	☐
Definition of model coverage criteria E.g. state coverage	☐	☐	☐	☐	☐
Decision on the automation degree	☐	☐	☐	☐	☐

Test analysis and design					
Review of the requirements	☐	☐	☐	☐	☐
Decision on the testability of the requirements	☐	☐	☐	☐	☐
Definition of test Steps	☐	☐	☐	☐	☐
Definition of test data	☐	☐	☐	☐	☐
Definition of test sequences	☐	☐	☐	☐	☐

Realization of the test cases (in case of test automation)	◘	◘	◘	☐	☐
Test execution and test cycle evaluation					
Test case execution	◘	◘	◘	☐	☐
Test case evaluation	◘	◘	◘	☐	☐
Test cycle evaluation	◘	◘	◘	☐	☐
Other activities					
	◘	◘		☐	☐
	◘	◘		☐	☐
	◘	◘		☐	☐
	◘	◘		☐	☐
	◘	◘		☐	☐

What experience can you access when performing testing activities?

Please check appropriate answers!

The role of the history of requirement's history for testing activities.

☐ I am aware of requirements that have been changed frequently before release.

This information is used in order to ….

(e.g. to define the test intensity for the corresponding requirements. Please indicate for which purposes do you use the history of a requirement during the testing process)

☐ I am aware of requirements that occur later (after release).

This information is used in order to ….

(e.g. to define the test intensity for the corresponding requirements. Please indicate for which purposes do you use the history of a requirement during the testing process)

☐ I am aware of requirements changed later.

This information is used in order to ….

(e.g. to define the test intensity for the corresponding requirements. Please indicate for which purposes do you use the history of a requirement during the testing process)

☐ I use the review protocols of the requirements specification during testing activities. I am particularly interested in:

(e.g. critical defects, number of critical defects, etc.)

This information is used in order to ….

(e.g. to define the test intensity for the corresponding requirements. Please indicate for which purposes do you use the history of a requirement during the testing process)

☐ I participate in review-meetings of the requirements specification. I categorize the following findings to be critical

(e.g. conflicting requirements, etc …)

The role of known defects for the testing process.

☐ I know previously found defects.
This information is used in order to ….

(e.g. intensify testing effort on this particular parts of the software.
Please indicate for which purposes you use the history of defects during the testing process!)

☐ I know previously found defects that have been detected by the customer.
This information is used in order to ….

(e.g. intensify testing effort on this particular parts of the software.
Please indicate for which purposes you use the history of defects during the testing process!)

☐ I participate in release-meetings.
During these meetings, I am particularly interested in:

This information is used in order to ….

☐ We monitor the defect density of particular software entities during the testing process.
This information is used in order to ….

(e.g. decide if testing activities can be finished. Please indicate for which purposes you use the history of defects during the testing process!)

The role of code during testing activities

☐ Complexity metrics are collected.
This information is used in order to ….

(e.g. define testing effort. Please indicate for which purposes you use complexity metrics during the testing process!)

☐ The size of modules is monitored during the testing process. This information is used in order to …

(e.g. define testing effort. Please indicate for which purposes you use a module's size during the testing process!)

☐ A module's state (e.g. new, changed, unchanged) is monitored during the testing process. This information is used in order to...

(e.g. define testing effort. Please indicate for which purposes you use a module's state during the testing process!)

✍ **What other experiences are useful when performing testing activities? When is a particular experience useful?**

Experience	... is needed for

Thank You for Your Cooperation!

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