Chapter 11
Presentation and Package

When an experiment is completed, the findings may be presented for different audiences, as defined in Fig. 11.1. This could, for example, be done in a paper for a conference or a journal, a report for decision-makers, a package for replication of the experiment, or as educational material. The packaging could also be done within companies to improve and understand different processes. In this case, it is appropriate to store the experiences in an experience base according to the concepts discussed by Basili et al. [16]. However, here we focus on the academic reporting in journals and conferences. If space limitations prevent complete reporting of all details, we encourage a technical report be published in parallel.

Jedlitschka and Pfahl propose a scheme for the academic reporting of experiments [86] which was later evaluated by Kitchenham et al. [101]. Jedlitschka and Pfahl's proposal is summarized in Table 11.1 and briefly elaborated in Sect. 11.1.

11.1 Experiment Report Structure

Structured abstract. The abstract should give the reader a quick summary of the key characteristics of the experiment. Structured abstracts are empirically demonstrated to be efficient tools to aid extraction of data [30] as well as writing good abstracts [31]. The elements of a structured abstract are:

- Background or Context,
- Objectives or Aims,
- Method,
- Results, and
- Conclusions

Example. An example of a structured abstract is presented to illustrate the items. In this case, the length of the structured abstract is limited to 300 words:

Context: Throughout an organization, people have different responsibilities and work tasks, hence, it is probable that different roles have different priorities when

Table 11.1 Proposed reporting structure for experiment reports, by Jedlitschka and Pfahl [86]

| Sections/subsections	Contents
Title, authorship	
Structured abstract	Summarizes the paper under headings of background or context, objectives or aims, method, results, and conclusions
Motivation	Sets the scope of the work and encourages readers to read the rest of the paper
Problem statement	Reports what the problem is; where it occurs, and who observes it
Research objectives	Defines the experiment using the formalized style used in GQM
Context	Reports environmental factors such as settings and locations
Related work	How current study relates to other research
Experimental design	Describes the outcome of the experimental planning stage
Goals, hypotheses and variables	Presents the refined research objectives
Design	Define the type of experimental design
Subjects	Defines the methods used for subject sampling and group allocation
Objects	Defines what experimental objects were used
Instrumentation	Defines any guidelines and measurement instruments used
Data collection procedure	Defines the experimental schedule, timing and data collection procedures
Analysis procedure	Specifies the mathematical analysis model to be used
Evaluation of validity	Describes the validity of materials, procedures to ensure participants keep to the experimental method, and methods to ensure the reliability and validity of data collection methods and tools
Execution	Describes how the experimental plan was implemented
Sample	Description of the sample characteristics
Preparation	How the experimental groups were formed and trained
Data collection performed	How data collection took place and any deviations from plan
Validity procedure	How the validity process was followed and any deviation from plan
Analysis	Summarizes the collected data and describes how it was analyzed
Descriptive statistics	Presentation of the data using descriptive statistics
Data set reduction	Describes any reduction of the data set e.g. removal of outliers
Hypothesis testing	Describes how the data was evaluated and how the analysis model was validated
Interpretation	Interprets the findings from the Analysis section
Evaluation of results and implications	Explains the results
Limitations of study	Discusses threats to validity
Inferences	How the results generalize given the findings and limitations
Lesson learnt	Descriptions of what went well and what did not during the course of the experiment
Conclusions and future work	Presents a summary of the study
Relation to existing evidence	Describes the contribution of the study in the context of earlier experiments
Impact	Identifies the most important findings
Limitations	Identifies main limitations of approach i.e. circumstances when the expected benefits will not be delivered
Future work	Suggestions for other experiments to further investigate
Acknowledgements	Identifies any contributors who do not fulfill authorship criteria
References	Lists all cited literature
Appendices	Includes raw data and/or detailed analyses which might help others to use the results
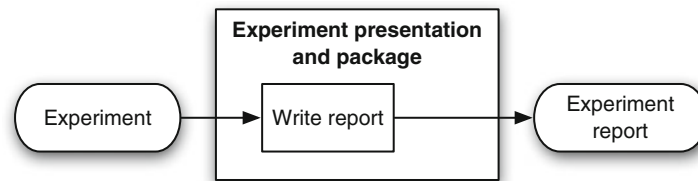
Fig. 11.1 Overview of presentation and package

it comes to what should be improved within a company. This has been found in previous studies in marketing, but is this true for software improvement as well? *Objective:* This paper evaluates how different roles in a software development organization view different issues in software process improvement and if such differences could be used in order to provide more tailor-made process improvements within an organization and uses this as a working hypothesis. *Method:* A quantitative questionnaire containing five different weighted questions related to software process improvement was developed. Eighty-four employees from all levels of a Swedish telecommunication company were then approached, of which 63 responded. *Results:* The different roles disagreed in three of the questions while they agreed in two of the questions. The disagreement was related to issues about importance of improvement, urgency of problems, and threat against successful process management, while the questions where the roles agreed focused on communication of the processes (documentation and teaching). *Conclusion:* It is concluded that it is important to be aware and take into account the different needs of different roles. This will make it possible to provide improvements tailored to specific roles which will probably help to overcome resistance to process improvements. It is also important to look into other areas and companies (for example, marketing) where it could be beneficial when conducting process improvements.

Motivation. The motivation or introduction set the scope and defines the objective of the research, hence it primarily reports the outcome of the scoping phase (see Chap. 7). Information about the intent of the work can also be included to clarify and capture the readers' interest. This provides the reader with an understanding of why the research has been carried out and why there is a need for it. The context in which the experiment is conducted should be briefly presented here.

Related work. Related work is important to provide a picture of how the current experiment is related to work conducted previously. Every experiment report does not need a complete systematic literature review (see Chap. 4), although being systematic in searching for literature is mostly beneficial. In particular, in the case of replication studies, all previous studies should be reported.

Experimental design. Here, the outcome of the planning phase is reported, see Chap. 8. The hypotheses, which are derived from the problem statement, are described in detail. The experimental design is presented, including the design

type, variables measured, both the independent and the dependent, as well as the instrumentation.

A description of how the data will be collected and analyzed should be included. A characterization of the subjects should be provided. The discussion about the experiment's conclusion, internal, construct and external validity should be provided here together with the possible threats against the plans.

The purpose for describing these items is to enable other persons to both understand the design so that it is visible to the reader that the results are trustworthy and to enable replication of the study. In short, it should help the reader to get deeper a understanding of what has been done.

Execution. The first part to describe is how the operation is prepared, see Chap. 9. It is important to include descriptions of aspects that will ease replication of the experiment and to give insight into how activities have been carried out. The preparation of the subjects has to be presented. Information such as whether they attended some lessons or not is important to provide. The execution of the experiment should also be presented and how data was collected during the experiment.

Validation procedures of the data collection are another issue that has to be stressed and it has to be reported if sidesteps have been taken from the plans. All information is aimed to provide a case for the validity of the data and to highlight problems.

Analysis. A presentation of the data analysis, where the calculations are described together with the assumptions for using some specific analysis model, should be provided. Information about sample sizes, significance levels and application of tests must also be included so that the reader will know the prerequisites for the analysis. The reasons for the actions taken, for example outlier removal, should be described to avoid misunderstandings in the interpretation of the results. For more information see Chap. 10.

Interpretation. Raw results from the analysis are not enough to provide an understanding of the results and conclusions from the experiment. An interpretation must also be provided, see Chap. 10. It includes the rejection of the hypothesis or the inability to reject the null hypothesis. The interpretation summarizes how the results from the experiment may be used.

The interpretation should be done with references to validity, see Chap. 8. Factors that might have had an impact on the results should be described.

Conclusions and further work. Finally, the discussions about the findings and the conclusions are presented as a summary of the whole experiment together with the outcomes, problems, deviations from the plans and so forth. The results should also be related to work reported previously. It is important to address similarities and differences in the findings.

   Ideas for future work might also be included in this section and information about where more information can be found to get a deeper insight to the experiment and to ease replication of the experiment.

Appendices. Information that is not vital for the presentation could be included in appendices. This could, for example, be the collected data and more information about the subjects and objects. If the intention is to produce a lab package, the material used in the experiment could be provided here.

11.2 Exercises

11.1. Why is it important to document an experiment thoroughly?

11.2. What is a lab package? Can you find any lab packages on the Internet?

11.3. Why is it important to report related work?

11.4. Why is it not enough just to provide the results from the analysis? In other words, why is a special interpretation of the results important?

11.5. Which in information in the report is most important when conducting a systematic literature review? When replicating an experiment?