

Poster: Knowledge Transfer from Research to Industry: A Survey on Program Comprehension

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ABSTRACT

The number of scientific publications is continuously increasing, with most publications describing research that is also interesting for industrial software engineers. Program comprehension in particular is an essential and time consuming task in industry, but new approaches are rarely adopted. We conducted a survey with 89 participants from research and industry to investigate this problem. Our results indicate that researchers have to integrate other ways to communicate their work and make evaluations more practical.

CCS CONCEPTS

• **General and reference** → **Evaluation; Empirical studies;**

KEYWORDS

Program comprehension, survey, knowledge transfer

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1 INTRODUCTION

Publishing papers is an essential task for researchers to share their results and extend our knowledge. Consequently, the number of scientific publications increases each year, making it more challenging to identify those that are relevant for the own work [2, 3]. In particular, this is a problem for practitioners, who, in addition, are not the addressed audience of such publications – with both issues preventing knowledge transfer and cooperation. Within this paper, we report barriers for knowledge transfer towards practice based on a survey among 89 participants. We focus on program comprehension as one of the most important and common tasks in software engineering [5, 6]. Our results indicate that the way

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research is reported and the performed evaluations are problematic for practitioners. We propose ways to tackle these issues.

2 THE SURVEY

For our survey, we recruited a heterogeneous group of 39 researchers, 38 practitioners, and 12 participants employed in both areas. An initial assessment of their knowledge shows that they have a mean programming experience of 10.13 years. The distribution of used programming languages and tools is similar to the TIOBE index.

Our survey was available online and required approximately 10 minutes – but participants were not forced to answer all questions. We implemented two sections, in which the participants describe (2.1) why they do not read scientific publications and (2.2) which evaluations would convince them to adopt research in practice. To promote our survey, we distributed it via social media, personal contacts, and mailing lists.

We used open-card sorting [1] to identify higher-order themes within the survey responses. Overall, we find five major concerns for each of the two survey sections. In the following, we provide an overview of these concerns and recommend potential solutions.

2.1 Missing Knowledge Transfer

In this section of our survey, we asked the participants to describe why they do not read scientific publications. We display an overview on the absolute numbers of responses in Figure 1.

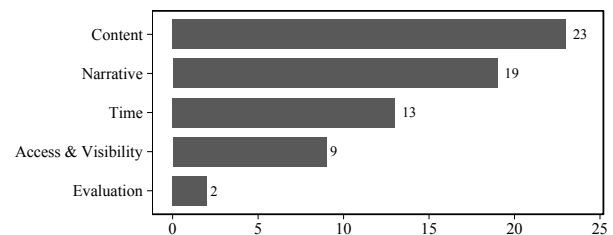


Figure 1: Total number of responses for missing knowledge transfer.

Content Research publications are often written in a research-oriented way, containing low practical value. Consequently, it is difficult to identify papers that describe applicable approaches or tools for practitioners. Furthermore, many approaches and tools are only developed until a paper can be written; opinions of practitioners and continuous support are often missing.

Narrative Practitioners prefer short descriptions and the possibility to test tools and approaches ad-hoc. They rather read publications and blogs of other practitioners, newsletters, or Twitter, as

such platforms condense information in a neat form and are more credible in their opinion.

Time The increasing number of publications makes it difficult and time consuming to identify relevant papers.

Access & Visibility The awareness that scientific publications exist is often missing, especially if practitioners never had contact to research. In particular, platforms used by practitioners rarely distribute information about research approaches and tools on program comprehension. An additional barrier are publisher paywalls that limit the access to most papers.

Evaluation In two cases, the evaluation of the conducted research is explicitly mentioned. We assume that the aforementioned concerns prevail, wherefore the evaluation part is rarely thought of without mentioning it. To address this, we focused the second section of our survey on this concern.

Recommendations:

- Provide a short and practice oriented summary – including examples and most interesting insights – of your paper.
- Make such summaries publicly available and distribute them through practice-oriented communication channels.
- Facilitate usability and provide support for your tools to transfer them into practice.
- Introduce practice-oriented communication channels at scientific venues and rely on established ones.

2.2 Gaps in the Evaluation Design

In the second section, we asked the participants which evaluations would convince them. To this end, we compare free-text responses with the evaluations applied in 25 user studies during 2012 and 2016 at the ICPC [4]. Some of the answers contained interesting remarks not concerned with the tasks and measurements.

Tasks As we show in Figure 2, most scientific publications contain tasks like comprehending, programming, modifying, or fixing code. In contrast, practitioners would prefer to learn about experiences of others in applying tools and approaches in the real world – including usability, satisfiability, and acceptance.

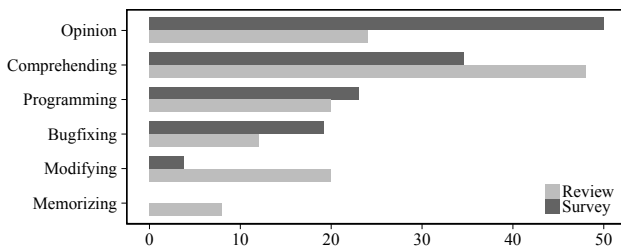


Figure 2: Percentages of used (review, 25 papers) and preferred (survey, 26 responses) tasks for evaluating program comprehension.

Measurements To evaluate task solutions, researchers mainly rely on measuring the required time, completeness, or response accuracy. As we display in Figure 3, practitioners almost solely consider time savings to be convincing.

Realistic Scenario For practitioners, realistic use-cases and illustrating the practical relevance of the research are more important than the evaluation itself. They also prefer field studies with experienced programmers over laboratory studies with students.

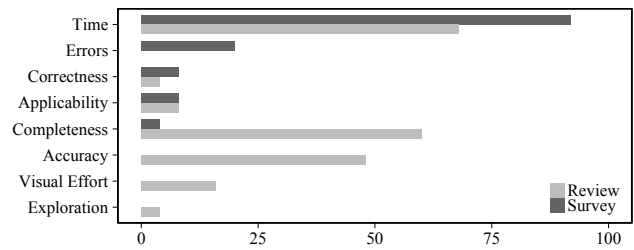


Figure 3: Percentages of used (review, 25 papers) and preferred (survey, 25 responses) measurements for program comprehension.

Learning Curve Some of our participants mention the learning curve as an important factor. Arguably, research approaches may be too difficult to learn and transfer fast enough into practice.

Credibility In some responses the credibility of user studies in general has been questioned. They would suffer from publication biases, authors' confirmation bias, result randomness, small samples, and potentially misleading data interpretation.

Recommendations:

- Describe the use-case and rely on practice-oriented metrics.
- Evaluate your approaches and tools by letting practitioners apply them – tracking measurements and asking for opinions to rise credibility.
- Improve your approaches based on practitioners' feedback and report their responses.

3 CONCLUSION

With the growing number of scientific approaches and tools, it becomes more challenging to monitor the corresponding publications. Consequently, practitioners face considerable efforts if they want to adopt new research ideas in industry. Based on our survey, we conclude that we need to improve two aspects in reporting research: Firstly, the way research is described and made available should (partly) be more practice-oriented. Secondly, evaluating approaches for program comprehension should be closer to industrial needs. In future work, we aim to extend our analysis and provide support to facilitate knowledge transfer into practice.

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