















# Educating RSEs in Germany - What Needs to Be Done

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**Abstract:** The previous papers dealt with a survey of the disparate sources of education for RSEs. A follow-up publication dealt with specific competencies that define and RSEs and have shown some career pathways that emerge from them. In the next paper we have set out structures that facilitate the education of RSEs, thereby setting the ground for this paper where we detail what needs to be done specifically in Germany.

**Keywords:** research software engineering, education policy, training, learning, competencies

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## 1 Required Next steps

### 1.1 Implementation Strategies

- Ideally over time scientific software engineering becomes part of the curricula at universities.

### 1.1.1 Academic Considerations

- Awareness of existing teaching programs
- “Branded” Add-on courses
- External Institutions provide resources
- fully recognised in the academic system. Students get ECTS points.
- Bachelor/Master specialisations

### 1.1.2 Broader Considerations

- Instilling more respect for people that want to educate themselves for digital competencies
- Outreach to people that now have the feeling that they require this training.

## 2 Conclusion

We have identified the RSE as an individual that contributes to research teams with their knowledge about digital tools. Then we have defined generic core competencies from the pillars of Software Engineering, Research and Team processes. We fleshed them out with some possible specialisations of RSEs. Given the competencies and a demand(FIXME: Do the calculation) in the research landscape for them we moved on to define who the teachers are for this new field. We closed with a discussion of possible structures and organisation forms that educate new generations of RSEs in more structured programs than what is available today. Therefore this closes the gap, that the research landscape requires RSEs, but there are no structures where these persons are educated, by detailing the career path that a young person might want to take to become an RSE.(FIXME: also aspirational...)

However, it is worth highlighting that answering the need for more RSEs can only be achieved by simultaneously having a clear training path, but also by ensuring that existing and trained RSEs are retained in academia. This paper focused on the first component: training RSEs, but we still believe that a discussion on creating viable RSE career paths in academia is necessary. This might be even more true for RSEs than traditional researchers as RSEs may have more opportunities to perform similar activities in the commercial sector, while benefiting from better salaries and working conditions.

RSEs are valuable members of research teams in academia, but the lack of institutional support leads to high turnover and difficulties attracting applicants with the right skill set. Several institutions have recognised these challenges and are taking steps to professionalise RSE profiles and make them more visible via dedicated funding programs [3, 2, 5, 4] or by establishing RSE departments. For the sake of completeness, we also would like to mention challenges that relate to the topic covered but are out of scope and would be subject of separate more in-depth considerations.

As outlined in Flemisch et al. [1], the lack of long-term funding options and centralised agencies complicate the sustainable development and delivery of research software. Where applicable, it is important to raise awareness of the need for institutional support. The creation of a curriculum for the continuing education of RSEs must go hand in hand with the creation of new permanent positions for RSEs at research institutions. For one thing, attractive working conditions are indispensable in order to employ RSE teachers, e.g. to attract qualified and experienced software engineers from the industry to the field of research software. For another thing, they are also important to retain trained RSEs at research institutions.

Training and building up experience in research software engineering also rely on the long-term availability of required (domain-specific) infrastructure for software development. If this prerequisite is not met in the first place, research institutions either have to enable RSEs to access infrastructure that already exists off-premise or they have to provide the required infrastructure on-premise. Sustainable software development benefits greatly from services for developing, testing and validating software. Specifically, the lack of hardware and personnel support for Continuous Integration (CI) and Continuous Delivery (CD) limits efficient and up to date software development.

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