Chapter 16

Teacher Education and Teacher Development

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Abstract The two chapters on teacher education for Interdisciplinary Mathematics Education are introduced. It is argued that teacher education is required for the innovations that interdisciplinarity demands, and that the success of interdisciplinary education stands or falls on the state of teacher preparation for it.

Keywords Teacher education · STEM education · Interdisciplinary teaching

Promoting STEM education is a main goal of educational policy in many countries worldwide. The scientific and technological progress, in commercial countries will persist, and thus people are needed who are qualified in Science, Technology, Engineering and Mathematics—the STEM fields. This is at the behest of companies, who have problems in recruiting, highly qualified engineers, and IT specialists, for example, and recently it has become a clearly defined educational goal, that STEM-programmes are supported by governments. In the United States, the initiative for STEM has a longer tradition (National Research Council, 2014) than in many other countries, although the interest of their students in the STEM-fields still remains rare. In this context the Obama administration announced the 2009 “Educate to Innovate” campaign to motivate and inspire students to excel in STEM subjects.

Similarly, results of a recently published report of the *status quo* of STEM-education in Europe, supported by the European Union (Galev, 2015), investigating teachers, students, and experts from industry, show that there has been some progress, but STEM-education in school is still taught mainly more theory-orientated than practice-orientated, within separated disciplines. One reason, among others, could be the fact that there is no systematic teacher education in this field in many European countries. The implementation of an interdisciplinary approach, from kindergarten age to school, and university, levels, is still a challenge for teachers, and for those who are educating the teachers. Interdisciplinary learning and teaching require, on the one hand, well-prepared teachers, and on the other hand, adequate teaching materials for every-day lessons in school (not to speak of curriculum and assessment regimes).

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In the following two articles, the reader gets an insight into good teacher education approaches for interdisciplinary teaching, and learning, in several countries. In particular, it becomes clear, how important collaborations between teachers from different disciplines are, and furthermore, how vital it is to make the effects of this interdisciplinary teaching explicit, and transparent, to colleagues.

The first article, by Boboňová, Čeretková, Tirpáková, and Markechová, shows the inclusion of the interdisciplinary approach in Biology Teacher Trainees in Slovakia. The researchers comment that there has been almost no significant progress in incorporating interdisciplinary approaches into teacher education curricula at universities in their country. This results from the fact that the curriculum in Slovakia is separated into Mathematics, Biology, Chemistry, Physics and Computer Science. In order to connect these fields, their study was conducted with the aim to develop modern teaching material for biology teacher trainees with respect to the interdisciplinarity of mathematic and biology. Furthermore, the research group focused on analysing the key mathematical competencies for biology teacher trainees, with respect to the requirements of modern biology education. Finally, the researchers received valuable, authentic, feedback from teacher trainees, to help university educators identify the areas of strength, and weakness, of the materials used in order to improve interdisciplinary teaching.

The second paper, by Wilhelm and Fisher, from the United States of America, with a focus on creating academic teacher scholars in STEM education by preparing pre-service teachers as researchers. The authors describe what Research Experiences for Undergraduates (REU) Fellows reported, regarding their experiences within a research-intensive programme in STEM Education. One main result of their study, was, that the Fellows most frequently noted the increase of their interpersonal collaborations with other future STEM teacher researchers. A characteristic, of the research, is the fact that it is the first to examine the effectiveness of an academic year long interdisciplinary STEM Education REU programme.

Both papers show that there is a lot of progress in STEM teacher education in different parts of the world. It becomes clear, that well-educated teachers for interdisciplinary teaching, who are trained in methods and content, are much needed. As well as these, and of other competencies, one aspect should be added, which we assume implicitly: we need teachers, who are open-minded enough not to see only their own favoured subject, or discipline, but who like to connect several disciplines, discuss their links with colleagues, create ideas, and make interdisciplinary teaching, and learning lively and motivating for their students.

References

- Galev, T. (2015). Status Quo der MINT-Bildung in Europa: Ergebnisse der MARCH Studie. *Projekt Lebenslanges Lernen*. Europäische Union.
- National Research Council. (2014). *STEM learning is everywhere: Summary of a convocation on building learning systems*. Washington, DC: The National Academies Press.

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