Shaping physics teacher education together: How to successfully connect didactics and scientific discipline?

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Abstract. Collaboration between educational science and physics as a scientific discipline ensures successful and competence-based physics teacher education. However, best practices for synergistic didactic concepts are widely missing. In the module "Applications in physics and their didactics", concepts from physics didactics and insights into current physics research are strongly entangled to create a holistic learning environment for advanced teacher students. Along the experiences we made within the development and implementation of this didactic concept, this workshop discusses reasons for the limited collaborations between the individual disciplines and creates strategies for overcoming them to establish a synergistic physics teacher education.

Missing links in academic teacher education

Academic teacher education in Germany is built onto the three pillars educational sciences, discipline-specific didactics, and the scientific discipline.[1] Although a synergistic approach, where these pillars are strongly entangled, is considered beneficial for the students' competence development, collaborations across their borders can be hardly found. Accordingly, students are often left alone with the challenge to transfer and harmonize the different concepts and knowledge cultures of the different scientific disciplines.[2,3] This applies especially to STEM fields and to collaborations between the discipline and the other two pillars. Already different academic biographies and scientific languages strongly impede collaborations. This does not only apply to Germany, but appears to be a global challenge in academic teacher education programs that needs to be overcome to improve the students' competence development.

Embracing changes together

At the 4th World Conference on Physics Education, stakeholders from the different pillars come together to present and discuss new insights on physics education. This is the perfect place to provide a hands-on workshop on synergistic physics teacher education being in full agreement with the theme of this year's conference. The workshop uses our experiences at the TU Dresden (see next section) to provide impulses for the discussion. However, the focus of the workshop is the discussion across the disciplines to:

A) Collect reasons for a synergistic teacher education,
B) Identify challenges that impede collaboration,
C) Discuss strategies to create collaborations on the educator level,
D) Discuss strategies to create an organisational environment for a synergistic teacher education.

At the stage of the submission of this contribution, the time frame for workshops was not yet defined. Accordingly, this list might require shortening. If enough time is provided, we prefer the application of the Disney method as it allows a shift of perspectives and the development of solution strategies without considering sceptic thoughts from early on.

Experiences from TU Dresden

Sebastian Schellhammer is a physicist, but also worked in the higher didactics department and the center for teacher education for several years. Frank Beier is educational scientist with several collaborations with discipline-based education researchers. Accordingly, our experiences relevant for this workshop are threefold:

1) In the module "Applications in physics and their didactics" physics didactics and physics as a scientific discipline collaborate to create a holistic learning environment for advanced teacher education students. For example, after receiving training in the design of out-of-classroom didactic concepts and basics in medical radiation science, the students visit a radiotherapy facility and create and discuss related short course concepts. Along the entire process, educators from physics didactics and medical radiation science collaborate to support the students in the combination and transfer of the competences gained. The module is received by the students very positively. They appreciate the authentic presentation of physics research and its hands-on transfer into different course concepts. Almost all of them expect that the inclusion of current research projects into their school classes increases the pupils' motivation for physical phenomena and the module promotes their competences to do so.[4]

2) In the project "TUD-Sylber: Synergetic Teacher Education within a Framework of Excellence", stakeholders of the three pillars as well as the center for teacher education of the university worked together for seven years to transfer the teacher education at the university to a more synergistic approach. Along this project, we collected various do's and don'ts to promote collaborations between educational sciences, discipline-specific didactics, and the scientific disciplines.

3) In the academic success project "Learning transfer methods", a multiplier program for highly active educators in STEM fields was established to strengthen their experience exchange.[5] Various collaborative solutions were tested that are also potentially able to build bridges between the stakeholders of the various pillars of teacher education.

References

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