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## Educational formalisation and research projectification create tensions and contradictions in externally funded doctoral education

Many authors (for example, Byrne et al., 2013; Kehm, 2020; Nerad, 2020; Taylor et al., 2021) describe how the ongoing process of formalisation has steered doctoral education worldwide towards structured curricula, more managerial control and new models for supervision. Absent from such accounts are the consequences for doctoral education of the last decades' changes in governance of research, sometimes referred to as the projectification (Ylijoki, 2016) of research. Research projectification is highly likely to have consequences also for doctoral education, in particular in STEM since doctoral students and their supervisors in these disciplines traditionally research and publish together.

To investigate the convergence of educational formalisation and research projectification on doctoral education we have conducted a study in the context of highly competitive, externally funded research in medicine and health sciences in Sweden (Sonesson et al., 2023). Using Cultural-historical activity theory and activity system analysis (Engeström, 1987, 1996, 2001) we were able to identify several contradictions and tensions that were consequences of the adaptation to formalisation and projectification. The contradictions were manifested in the tying of doctoral students to their supervisors' projects and careers, and by extension to an economy of publications and research grants, and in students being deprived of opportunities for learning and developing independence. Supervisors were torn between supervision and project management while doctoral students had to balance being students and project members. Our result provide a system level explanation to previously reported pedagogical and ethical challenges in STEM doctoral education.

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