Discovery, characterization and implementation of novel polyester depolymerizing enzymes

Verschoor, J.

Contributions to teaching

During the past 5 years I participated in a pilot allowing PhD students an extra year to develop and deepen their teaching skills with as final goal obtaining their university teaching Qualification (UTQ). This extra year is spread over the timespan of their PhD to allow systematic course work. This allows to extend your teaching skills and build courses over the years based on evaluations and results of students.

During my teaching trajectory I was involved in the coordination, teaching and improvement of the master course *Genomic Architecture*, I taught lectures regarding my own expertise in the course *From Gene to Biobased Product* (Minor Biotechnology), supervised small groups of students for *Biotechnology Science Projects and Entrepreneurship* and supervised 9 master and 10 bachelor thesis students (Tabel 1). The majority of my teaching tasks was conducted in English; thus, I obtained the BKE to allow for teaching in English.

Tabel 1: ***Overview of teaching responsibilities***

Course	ECTS	Niveau	Educati-on level	Number of students	Task	Year
Genomic architecture	6	400	MSc	100-200	Shared coör-dination, grad-ing, teaching lectures, teaching work-shop	2020-2024
From gene to biobased product	6	300	BSc	40	Teaching lectures and small coordi-nation tasks	2021-2024
Biotechnol-ogy Science Projects and Entrepeneur-ship	12	400	BSc	5-10	Supervise re-search project writing	2020-2024
Supervising thesis stu-dents	24-45	400-600	BSc & MSc	19	Supervising in-ternships and thesis writing	2020-2024
Molecular microbiology	6	400	BSc	50	Assisting prac-tical	2021-2021

The courses I was involved in were predominantly taught in the first semester allowing me to focus on my research and personal course work (UTQ/PhD courses) during the second semester. Student supervision was always scattered over the whole year. The systematic involvement in education allowed me to think critically about the ways we provide education and how we teach. Obtaining the UTQ allowed me to link the

University view on teaching to my own teaching and courses, how to meet the level that is required from the students. My presentation skills have improved, and I was able to adjust my lectures according to the background and needs of the students. One of my favorite aspects of teaching is the individual guidance of students during internships. I think it is a privilege to contribute to the scientific careers of these students and shape their interest in academia. Following courses regarding student supervision, gave me a lot of perspective regarding supervising students and how to meet the needs of individual students to facilitate them in their teaching, allowing me to grow as a supervisor. I am also very happy that I was able to incorporate a lot of work from my students in this thesis and even in some scientific articles thereby also boosting their confidence.

Not only did I develop as a teacher and supervisor but also the education landscape has changed over the past 5 years. Especially the COVID-19 pandemic had a pivotal role in the shift in education requirements and needs. The lack of physical education and shift to online classrooms put strain on both students and teachers. The advancements in technology, the wider acceptance of online education and rise of AI have resulted in education that is more accessible and inclusive for students. However, it is important to keep in mind to use these technologies as support to improve skills instead of simply generating answers to questions, or reports to assignments.

In my opinion, this pilot “Teaching for PhDs” really enriched my PhD trajectory and boosted my confidence and skills. It provided a mirror to reflect on my own teaching and transferrable skills. It was a very valuable process which I believe would benefit many PhD candidates. I will take these skills into my further career where I hope to continue teaching.

Curriculum vitae

Jo-Anne Verschoor was born on the 27th of September, 1996 in Rotterdam the Netherlands. She attended VWO with the specialization Science and Health at “het Lyceum Vos” in Vlaardingen where she graduated in 2015.

In 2015, she started the bachelor’s in biology at Leiden University with a focus on microbiology. During her studies she participated in the Study of the US institutes leaders of Europe program focusing on environmental issues at the University of Oregon in the United States fostering her interest in sustainability. She graduated from her bachelor in 2018 and pursued a masters in “Molecular genetics and biotechnology” at Leiden University where she worked on an alternative plasmid selection system for *Streptomyces lividans* under supervision of Dr. Erik Vijgenboom. She participated in the 2019 iGEM team as a science manager where they worked on the expression of squid proteins in *E. coli* winning the Best Manufacturing prize at the Jamboree in Boston. Her second master internship combined her interest in sustainability and microbiology by researching plastic degradation by *Streptomyces* species under supervision of Dr. Mia Urem, Prof. Dr. Arthur Ram and Prof. Dr. Han de Winde for which she received the Unilever research prize.

She was able to continue these studies during her PhD within the group of Prof. Dr. Han de Winde in close collaboration with the group of Prof. Dr. Arthur Ram as described in this thesis. During her PhD she actively participated in organizing social events as member of the BioSpirits and chair of the IBL PhD and Post-Doc association. She was part of the company emergency response ream (BHV). To stimulate visibility and scientific outreach she participated in several outreach activities including the museum night, Micro-day, teaching special education, Science summer school, the Vuurvliegen competition, interviews in newspapers and more. Additionally, she was granted an extra year to dedicate to teaching, she assisted, taught and coordinated several courses, guided many students and finally obtained the University Teaching Qualification (UTQ) at the start of 2025. The results of her PhD research are presented in this thesis.

List of Publications

Verschoor, J., Kusumawardhani, H., Ram, A. F. J., & de Winde, J. H. (2022). Toward Microbial Recycling and Upcycling of Plastics: Prospects and Challenges. In *Frontiers in Microbiology* (Vol. 13). Frontiers Media S.A. https://doi.org/10.3389/fmicb.2022.821629

Kusumawardhani, H., Hosseini, R., **Verschoor, J.**, & de Winde, J. H. (2022). Comparative analysis reveals the modular functional structure of conjugative megaplasmid pTTS12 of Pseudomonas putida S12: A paradigm for transferable traits, plasmid stability, and inheritance? *Frontiers in Microbiology*, *13*. https://doi.org/10.3389/fmicb.2022.1001472

Verschoor, J., Croese, M. R. J., Lakemeier, S. E., Mugge, A., Burgers, C. M. C., Innocenti, P., Willemse, J., Crooijmans, M. E., van Wezel, G. P., Ram, A. F. J., & de Winde, J. H. (2024). Polyester degradation by soil bacteria: identification of conserved BHETase enzymes in Streptomyces. *Communications Biology 2024 7:1*, *7*(1), 1–13. https://doi.org/10.1038/s42003-024-06414-z

Verschoor, J., Arentshorst, M., Regensburg-Tuink, A. J. G., Seekles, S. J., Van Den Hondel, C., De Winde, J. H., Ram, A. F. J., & Gralnick, J. A. (2025). Heterologous expression and characterization of synthetic polyester-degrading cutinases from Fusarium spp. in Aspergillus niger. Microbiology Spectrum. https://doi.org/10.1128/SPECTRUM.02177-25