











VIEWPOINT

# Uniting education, research, healthcare, and society to advance women’s heart health

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**Complex health challenges require professionals to operate across disciplines and to better connect with society. Here, we showcase a community-engaged and challenge-based educational model in which undergraduate students conduct transdisciplinary research on authentic complex biomedical problems. This concept reinforces translational medicine, human capital, and exemplifies synergy between education, research, healthcare, and society.**

## Introduction

Life and health(care) change rapidly, presenting increasingly complex challenges that require academic professionals to collaborate across diverse scientific fields, engage with patients, and interact with society in a creative search for new and innovative solutions. Current higher education curricula are often insufficiently equipped to train future academics to address and research these multifaceted challenges effectively. Consequently, there is a pressing need for research-based transdisciplinary educational strategies harboring translational medicine that maintain a close connection with patients and societal needs.

Translational medicine focuses on optimizing the route of translating fundamental

scientific knowledge into real-world health impact. This is achieved by promoting enhancements in clinical application and by combining disciplines, resources, expertise, and techniques in the health domain (Albani and Prakken, 2009; Cohrs et al., 2014; Weber, 2013). Core translational medicine skills, called 4Cs, include collaboration, communication, critical thinking, and creative problem-solving (P21Framework Definitions, 2019). Students can develop such academic skills in a didactic framework of social constructivism (Bada and Olusegun, 2015) with elements of community-engaged (Boone et al., 2022), challenge-based (Valentijn et al., 2024), research-based (Healey and Jenkins, 2009), and inquiry-based learning (Healey and

Jenkins, 2009). Furthermore, students are motivated by patient participation (Sacristán et al., 2016; Sharma et al., 2018) and authentic learning (Lombardi, 2007; Valentijn et al., 2024).

We believe that students should engage in translational medicine with (i) research on complex real-world authentic challenges, (ii) collaboration in transdisciplinary research teams, (iii) the research cycle, and (iv) connections to role models, stakeholders, and society (Bovenschen et al., 2020; Drost et al., 2019; Schakelaar et al., 2022; Schot et al., 2021; Valentijn et al., 2024). This can already take place in the early undergraduate phase and help students to create an open attitude in future endeavors. For this pedagogic strategy to

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Figure 1. **Translational medicine concept that combines healthcare, education, and research to create societal impact.** Healthcare, education, and research are blended from the first day of the think tank when patients, healthcare professionals, researchers, and other stakeholders meet with undergraduate students to pose the health challenge (phase 1, left picture). The best, student-generated, research proposal is executed in phase 2 where students can choose from a Student Research HUB Network (right picture) in which all HUBs contain expertise in different disciplines. Students collaborate across disciplines and create societal impact together with patients, healthcare professionals, researchers, and other stakeholders.

succeed, research, education, and society should be blended and seamlessly integrated to ensure collective benefit or even synergy.

Here, we showcase a novel connected educational concept; in phase 1, over 400 undergraduate students from Utrecht University (that work toward an academic bachelor's degree [BSc]) designed research proposals that addressed spontaneous coronary artery dissection (SCAD), a heart disease that predominantly occurs in women. In phase 2, the best research proposal was executed by 23 undergraduate students from different disciplinary perspectives in a newly developed Student Research HUB Network.

#### Student Research HUB Network

To facilitate transdisciplinary student research, we set up a Student Research HUB Network (<https://www.studentresearchhubnetwork.com/>) within and outside of University Medical Center Utrecht and Utrecht University, the Netherlands (Schakelaar et al., 2022). Student research HUBs are physical innovation spaces devoted to students, each with a specific expertise. These HUBs are located within the heart of university faculties and have short lines of communication with local research, faculty, patients, and society. Students can work together within and between Student Research HUBs. As an example, the Biomedicine Student Research HUB (<https://www.biomedicinenstudentresearchhub.com/>) is a well-equipped wet laboratory fully dedicated to (under)graduate students to participate in authentic biomedical research with

stakeholders. Other Student Research HUBs include the Biotechnology, Epidemiology, Medical Humanities, Business & Entrepreneurship, Artificial Intelligence, Global Health, and Regenerative Medicine Student Research HUBs, among others.

#### Educational concept

The educational concept consists of two phases: (i) writing research proposals in the “Transdisciplinary Health Challenge Think Tank” and (ii) executing the best-ranked research proposal in the courses “Experimental Translational Medicine (ETM)” and “Research Project (RP)” (Fig. 1).

In the first semester of the biomedical sciences and medicine undergraduate programs at the Faculty of Medicine, Utrecht University (Utrecht, the Netherlands), ~50 h divided over 4 wk were allocated for the Transdisciplinary Health Challenge Think Tank. This think tank was attended by >400 undergraduate students from both programs (Fig. 1, phase 1). The best proposal from the think tank served as the starting point for the subsequent ETM and RP courses, which were 10-wk, full-time, 15 European Credits Transfer System elective research courses embedded in the last semester of the academic year. The courses were attended by >20 students coming from undergraduate programs in biomedical sciences, medicine, biology, molecular and biophysical life sciences, chemistry, pharmacy, College of Pharmaceutical Sciences, and University College Utrecht of Utrecht University (Fig. 1, phase 2).

#### Phase 1: Transdisciplinary Health Challenge Think Tank

Every academic year, students are introduced to a societally relevant health challenge in a plenary session with patients, healthcare professionals, researchers, and other (extra-)academic stakeholders, all of whom present their experiences and points of view, ultimately posing the challenge to students. Each year, a new topic for the health challenge is selected. From October to November 2023, students were presented with the women's heart challenge SCAD, a heart disease that predominantly occurs in females. Students were asked to write an empiric research proposal focusing on either prevention, diagnosis, treatment, or in vitro modeling of SCAD. One student said, “The fact that the best proposal was going to be executed in the research phase motivated me enormously.” Research proposals had to involve at least two disciplinary HUBs of the Student Research HUB Network. During workgroups, students were guided on transdisciplinary collaboration by educationalists and (bio)medical content by experts in the field. On the final day of the first phase, 24 student groups presented their innovative proposals via (oral) presentations. The best and most feasible proposal was selected by a jury of stakeholders for execution in phase 2. In phase evaluations, one student wrote, “It was an authentic and complex societal challenge to which we, already as undergraduate students, could contribute. It was a wonderful experience to be challenged by real

researchers and work together towards feasible and novel solutions.”

### Phase 2: Research courses

For the execution of the best research proposal for the SCAD women’s heart challenge (from April to June 2024) participating student research HUBs, selected by students, included the Biomedicine, Biotechnology, Cardiovascular Epidemiology, and Medical Humanities Student Research HUB. The 23 enrolled students performed authentic full-time research for 10 wk, ranging from wet laboratories to humanities and epidemiology. The types of research included biomedical laboratory work with SCAD cells and tissues, qualitative research including questionnaires and interviews, and epidemiological research with big data and statistics. A student mentioned, “I really liked the amount of research experience that I obtained during this course.” Weekly meetings between Student Research HUBs were held to discuss preliminary results, current literature, and future steps with all students, patients, researchers, healthcare professionals, and other stakeholders. These meetings connected all people involved, albeit from different disciplinary perspectives and physical locations. Additionally, patients and patient organizations were closely involved during the research courses. For example, patients with a history of SCAD visited the Student Research HUBs to participate in the research itself and to provide their points of view. In turn, they received layman presentations on the research data from the students. For practical guidance, HUB faculty and SCAD expert researchers provided the necessary knowledge, experience, and research tools. At the end of phase 2, students reported their work in a collaborative manuscript, including a group reflection on the transdisciplinary process and outcomes of the course and a conference-style oral presentation that was delivered to all stakeholders and patients. A student wrote, “It was the best course that I performed during my undergraduate degree.”

### Societal impact and public outreach

The rationale of this educational concept is to train students to collaborate across disciplines while finding creative solutions to authentic problems. This approach prepares future professionals better for their scientific careers and develops crucial (soft) skills that are required in solving the complex challenges of tomorrow. Moreover, the student-generated original research proposals that were conceived and executed during the SCAD women’s heart challenge not only impacted student learning but were also of significance for SCAD researchers: “One researcher wrote: The think tank provided us with some out-of-the-box research proposals of outstanding quality. Subsequent execution of the best idea has offered my research group valuable preliminary data for grant applications.” Furthermore, the link with society was established and maintained by consistently involving healthcare professionals, stakeholders, and five patients with a history of SCAD, one of whom said, “I feel heard by the many students, researchers, and doctors, and I was flabbergasted by the contributions from all people that have contributed to tackling my disease.” Hence, we believe that we have exemplified synergy between undergraduate education, research, healthcare, and society. Our future approach keeps focusing on the tandem of think tank with authentic research to tackle societally relevant problems. In the next academic year, this method will be employed to find novel solutions for neurogenic muscle diseases. We envision expanding the Student Research HUB Network with additional disciplines (e.g., social sciences and history). Simultaneously, we are working on bringing this concept into national and international university alliances (e.g., CHARM-EU). Internationalization fosters the intercultural perspectives needed to tackle sustainable solutions for complex global challenges.

In summary, this educational concept teaches us that bench-to-bedside translational medicine with a patient-centered challenge, authentic (bio)medical research, and subsequent translation to society is invaluable to create impact, not

only to motivate and train a future generation of scientists but also to improve patient lives.

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