

Physics for non-physicists - A scientific propaedeutic for prospective medical students

Lars-Jochen THOMS (1,2), Thomas FRANK (3), Mihály HÖMÖSTREI (4,5),
Florian BERNHARD (6), Julia KARMANN (7), Christoph HAMMER (8)

(1) Chair of Science Education, Thurgau University of Education, Unterer Schulweg 3, 8280 Kreuzlingen, Switzerland

(2) Chair of Science Education, University of Konstanz, Universitätsstr. 10, 78464 Konstanz, Germany

(3) Otto-von-Taube-Gymnasium, Germeringer Straße 41, 82131 Gauting, Germany

(4) Eötvös Loránd University, Egyetem tér 1-3, 1053 Budapest, Hungary

(5) Deutsche Schule Budapest, Cinege út 8/C, 1121 Budapest, Hungary

(6) Ammersee-Gymnasium, Dießener Str. 100, 86911 Dießen am Ammersee, Germany

(7) Gymnasium Donauwörth, Pyrkstockstraße 1, 86609 Donauwörth, Germany

(8) Institute of Mathematics, Osnabrück University, Albrechtstr. 28a, 49076 Osnabrück, Germany

Abstract. We present a propaedeutic program aimed at prospective medical students, focusing on enhancing their understanding of physics and natural sciences. Recognizing the importance of these fields in medical studies and the challenges students face in achieving high grades in natural sciences, the program offers hands-on experimentation and research opportunities. Initiated by the German Student Scholarship and the Else Kröner Fellowship, it targets disadvantaged youth aspiring to study medicine. The program, evaluated over two cohorts, demonstrates significant success and acceptance among participants, underscoring the necessity of scientific foundational knowledge for a successful medical career.

Introduction

In medical studies, a profound understanding of natural sciences, particularly physics, is essential. For example, concepts such as blood pressure, the heart's dipole moment, respiratory pressure, surface tension, and their implications on conditions like asthma, are foundational in understanding the human body's functions. Therefore, it is paramount for prospective medical students to acquire as much knowledge as possible in physics, chemistry, and biology during their school education. However, these subjects, especially physics, are often considered challenging, making it relatively harder for students to achieve high grades compared to other subjects. Given the limited admission slots for medical studies, governed by the grade point average in the German *Abitur* (secondary school leaving exam) through a system known as *Numerus clausus*, many students aiming for a medical career opt out of choosing physics or any natural science as their advanced courses during the final two years of school. Consequently, many aspiring medical students lack essential natural science knowledge and familiarity with scientific methodologies, both crucial for a successful medical career.

Methods

The German Student Scholarship (*Deutsches Schülerstipendium*) aims to support disadvantaged youth during their school years. Within this framework, the *Else Kröner Fellowship* is targeted at scholarship recipients who aspire to study medicine [1]. This fellowship includes participation in a scientific preparatory course (Propaedeutic), focusing on the natural sciences of physics and chemistry [2]. The program allows participants to engage with scientific methodologies, particularly through hands-on experimentation, offering a freer environment than typically available in school settings [3,4]. The propaedeutic comprises two

in-person phases and an intermediate project phase, during which the fellows conduct their research projects under guidance. This program has been completed by two cohorts of fellows and evaluated both qualitatively and quantitatively.

Results

The experiences from the first two years of the project indicate that the scientific propaedeutic has been highly successful and well-received by participants. However, detailed analyses suggest a need for more independent implementation by students in the project phases, especially when these phases coincide with final exams.

Conclusion

This presentation introduces the program, with a focus on the physics-related components, and presents lessons learned from the first two project cycles. It highlights the significance of integrating scientific propaedeutics in the educational pathway of prospective medical students, aiming to bridge the gap in natural science knowledge and methodology essential for a successful medical study. Through this initiative, the project demonstrates a viable approach to enhancing the scientific foundation of future medical professionals, addressing the educational challenges faced by students with limited exposure to rigorous natural science education due to the structural constraints of secondary education systems.

References

- [1] <https://www.rolandbergerstiftung.org/das-deutsche-schuelerstipendium/else-kroener-fellowship>
- [2] <https://www.rolandbergerstiftung.org/das-deutsche-schuelerstipendium/else-kroener-fellowship/abschlusswochenende-naturwissenschaftliches-propaedeutikum>
- [3] L.-J. Thoms, A. Finger, C. Thyssen, L.-J. Thoms, Digitale Kompetenzen beim Experimentieren fördern: Schülerexperimente zur Messung der Periodendauer eines Fadenpendels und zur Bestimmung des Ortsfaktors [Promoting digital competencies during experimentation: Student experiments for measuring the period of a pendulum and determining the gravity of earth]. *Naturwissenschaften im Unterricht Physik* **179** (2020) 23-27.
- [4] T. Frank, L.-J. Thoms, Digitale Kompetenzen beim Experimentieren fördern: Ortsfaktorbestimmung mit verschiedenen Sensoren im Physikunterricht [Promoting digital competencies during experimentation: Determining the gravity of earth with various sensors in physics lessons]. *PhyDid B*, 2021.