[University of Stavanger, IMF] [case number 2]

Institution: University of Stavanger (UiS)
Administrative unit: Department of Mathematics and Physics (IMF)
Title of case study: Skolebesøk / School visits
Period when the underpinning research was undertaken: Since 2012 and onwards
Period when staff involved in the underpinning research were employed by the submitting institution: From 2012 and onwards
Period when the impact occurred: 2019-onwards

1. Summary of the impact (indicative maximum 100 words)
This section should briefly state what specific impact is being described in the case study.

The institute runs a very successful project "Skolebesøk" that enables institute researchers to visit upper secondary schools all over Norway and present the main findings and background for their research. This project disseminates research results into the wider community, inspires the next generation of researchers and supports schoolteachers in their vital societal role. The project was begun in 2019 but has since been extended and is still ongoing due to its success and the clear societal needs it addresses.

2. Underpinning research

- Reference 1 discusses possible materials for hydrogen storage and in general energy storage. Green transition and energy have been topics nationally in the past decade. Presenting this research work in schools shows what solutions are being developed and integrates with classroom discussions about the challenges and potential of various renewable energy sources.
-

  References 2 and 4 deal with both the standard model of particle physics and cosmology. This research addresses fundamental questions about how the standard model of particle physics can be extended and what impact this may have for the evolution of the universe and its overall structure. These topics are very popular with students and teachers alike.

  References 3 and 6 below relate to medical statistics. Presenting these in schools demonstrates how we use mathematics and statistics to assess safety and mitigate diseases. Covid was a very big topic in the media and the daily lives of students in 2021-2022 and so these topics provide an excellent jumping off point for discussing statistics and how we quantify uncertainties in epidemiology.
-

  Presenting reference 5 in schools provides students with an insight into the new astronomical field of gravitational waves. It shows how relatively simple statistical tools can be used to identify gravitational wave signals that are many times quieter than the ambient noise level. This work is also particularly suited to presentation in schools since it addresses some claims in the media that gravitational waves had not in fact been detected convincingly and allows a broader discussion with the students about the role of the media in portraying scientific research results.

3. References to the research (indicative maximum of six references)

An indicative selection of research relevant to the project is listed here.

1) Recent progress in magnesium borohydride Mg(BH4)(2): Fundamentals and applications for energy storage.
Zavorotynska, O.; El-Kharbachi, A.; Deledda, S.; Hauback, B. C.,
International Journal of Hydrogen Energy 2016, 41 (32), 14387-14403. August 2016, DOI: 10.1016/j.ijhydene.2016.02.015

2) Dimensional reduction of the Standard Model coupled to a new singlet scalar field
Tomáš Brauner, Tuomas V. I. Tenkanen, **Anders Tranberg**, Aleksi Vuorinen, **David J. Weir**
Journal of High Energy Physics 03 (2017) 007, March, 2017
DOI: 10.1007/JHEP03(2017)007

3) Thyroidectomy Versus Medical Management for Euthyroid Patients with Hashimoto Disease and Persisting Symptoms. A Randomized Trial
Ivar Guldvog, MD, PhD, Laurens Cornelus Reitsma, MD*, Lene Johnsen, MD*, Andromeda Lauzike, MD, Charlotte Gibbs, MD, Eivind Carlsen, MD, Tone Hoel Lende, MD, Jon Kristian Narvestad, MD, Roald Omdal, MD, PhD, **Jan Terje Kvaløy**, PhD, Geir Hoff, MD, PhD, Tomm Bernklev, PhD†, and Håvard Søiland, MD, PhD
Annals of Internal Medicine 170(7):453-464, March 2019. DOI: 10.7326/M18-0284.

4) A study of inhomogeneous massless scalar gauge fields in cosmology
Ben David Normann, Sigbjørn Hervik, Angelo Ricciardone, Mikjel Thorsrud
Contribution to: MG15, 1378-1383, September 2019
DOI: 10.1142/9789811258251_0199

5) Pearson cross-correlation in the first four black hole binary mergers
Paolo Marcoccia, Felicia Fredriksson, **Alex B. Nielsen** and **Germano Nardini**
Journal of Cosmology and Astroparticle Physics 11 (2020) 043, August 2020. DOI 10.1088/1475-7516/2020/11/043

6) A Risk Model of Admitting Patients with Silent SARS-CoV-2 Infection to Surgery and Development of Severe Postoperative Outcomes and Death. Projections Over 24 Months for 5 Geographical Regions
Soreide, Kjetil MD, PhD, FRCS, FACS∗,†; Yaqub, Sheraz MD, PhD, FEBS‡; Hallet, Julie MD, MSc§,¶; **Kvaløy, Jan Terje** PhD‖,∗∗; **Kleppe, Tore Selland** PhD
Annals of Surgery 273(2):208-216, February 2021. DOI: 10.1097/SLA.0000000000004583

4. Details of the impact (indicative maximum 750 words)

When the project was started, we were delighted by the response from schools, which indicated a very real need for researchers and cutting-edge research in schools. Because of Covid and other constraints, visits have been performed both physically and digitally. The students are given the opportunity to interact directly with researchers, ask questions and are challenged to think critically about the questions raised by the research.

While not all of the research produced by the institute (administrative unit) is suitable for presentation in schools, there are many research results that are. These are often connected to wider societal challenges, such as medical statistics and pandemics, climate change and energy transition and the search for origins in cosmology and fundamental physics. An initial list of potential presentation topics was prepared by the institute and sent to schools across the country. Schools could then choose which topics would fit best with their needs and interests and researchers could be matched with schools as necessary. Presentation materials and presentation ideas were shared across the institute and almost all members of the institute have had the opportunity to participate.

A main driver of the project is to bring research results to the classroom along with appropriate background to understand their relevance. This provides essential motivation and context for the students' learning at schools. It directly connects their classroom experience to the research frontier and aims to inspire their future career choices. It is important for actual research to be presented in the schools. It is a great benefit for the students to see and meet researchers in real life, as opposed to the often one-sided caricatures presented in the media. Students are presented what it actually means to do research through the peer-review and journal process. While not all students aspire to be researchers in their future careers, the ones that do are often isolated and disconnected. Meeting researchers from the university can often be essential in encouraging them to persevere with their ambitions.

The project additionally provides welcome support for the teachers and bridges the gap between the university and schools. With the emphasis on broad, inquiry-based learning in the Norwegian school curriculum, teachers can often combine the researcher visits directly into ongoing lesson plans in STEM subjects. Most of the research presented in the schools is directly relevant to elements in the school curriculum, or as applied case studies to show the application of elements of the school curriculum.

The short-term impact of the project is assessed by written and verbal feedback from students and teachers. This feedback has been very positive, as evidenced by many repeat invitations. The longer-term impact, of inspiring the next generation of researchers, is harder to quantify and cannot be assessed at the present time. This impact is however no less important than the short-term impact.

Since the project started in 2019, we have visited the following upper secondary schools in Norway. This is an ongoing project and we have now visited multiple schools, multiple times and hope to extend this even further**.**

Ølen vgs
Sortland vgs
Kvitsund Gymnas, in Telemark
Arendal vgs
Bamble vgs
Gjennestad vgs
Rjukan vgs
Drottningborg vgs
Sandnes vgs
St. Svithun vgs, Stavanger
Hetland vgs, Stavanger

Sola vgs
Skeisvang vgs
Strand vgs
Dalane vgs
Spjelkavik vgs
Molde vgs
Sykkulven vgs
Volda vgs
Rauma vgs, Åndalsnes
Edvard Munch vgs., Oslo
Fyrstikkalleen skole, Oslo
Meløy vgs, Nordland

5. Sources to corroborate the impact (indicative maximum of ten references)

Bente Espedal, head of science, Sandnes vgs., bente.espedal@skole.rogfk.no, 95 44 41 48

Joao Loureiro, head of science and sport, Stord vgs., jll@vlfk.no, 93 03 15 66

Margrethe Steine Solevåg, teacher, Molde vgs, margrethe.steine.solevag@mrfylke.no, 98 66 56 22