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Connecting students with the Arctic: Live classroom online teaching from the Arctic to the USA and Europe: five case studies

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Abstract
Researchers working in polar regions face unique challenges not only in terms of environmental extremes and logistics, but also with respect to communications and commitments at their home institutions. With the increasing availability of high-speed internet at remote polar locations, some of these constraints are now diminishing. Polar scientists now have opportunities to communicate in realtime, including directly into universities, schools and public spaces. This paper explores the practicalities and implications of online teaching at institutions in the UK, USA, Germany and France, delivered from the remote Hamlet of Pond Inlet in the Canadian High Arctic by three of the authors. In this qualitative experiential study, the experience of an expedition to the region in early spring 2023 showed that, despite some remaining technical challenges, live teaching from remote locations in the Arctic to secondary, further and higher education institutions can engage with students. The technology to allow this is now a realistic but still limited option, providing students with an unprecedented learning experience. Such communications might help to inspire a new generation to understand and value polar regions.

Keywords
Arctic teaching, higher education, Nunavut, Pond Inlet, satellite internet, secondary education

Introduction

The Arctic and Antarctic include some of the most remote regions on Planet Earth from the perspective of the great majority of the world's human population. The remoteness also poses significant challenges for conducting scientific research in terms of logistics, health and safety as highlighted in the case of a scientific diving project in northern Baffin Island (Kleinteich et al. 2012; Kleinteich et al., 2013; Sayer et al., 2013; Küpper et al., 2016; Kleinteich et al., 2017a; Kleinteich et al., 2017b). Among researchers, there is a need and determination to work in the Arctic, despite the challenges (Olsen and Gunnarsdóttir, 2018). But due to difficulty of access and the high likelihood of disruption by external factors (chiefly weather), research trips to polar regions are often inherently longer than comparable trips to many other regions on Earth. This poses challenges for scientists who are often employed in faculty positions, with significant professional obligations at home.

There were an estimated 4,500 polar scientists in 2023 (Nunn et al. 2023), the majority of whom were likely to be primarily based in a home university or research institute thousands of kilometres from the nearest polar region. That separation is both from colleagues and from family back home (Jones, 2022). But during the last 30 years, and especially with WhatsApp and similar applications, communication with scientists in polar regions has become reliable and affordable (Jones, 2022). This has been essential for scientists who might not otherwise participate in polar field work (Johnson, 2015). Apart from personal contact, the revolution in communications has also enabled polar scientists to 'spread the word' about the science that they do. There is a substantial interest in polar science, and the scientists have an opportunity or even an obligation to communicate with the public (Steins, 2025). Polar scientists now also have a chance to inspire a new generation of inquisitive minds (Węsławski, 2020). Approaches include classroom teachers working with polar scientists (Beck *et al*. 2014; Warburton *et al*. 2019). Another approach, which we are describing in this paper, is for polar scientists to communicate *directly to* the classroom in a live feed.

Polar scientific disciplines have long been met with a high degree of interest by students, especially in secondary and tertiary education – and they contribute a unique prestige for the institutions where they are conducted. Students are often aware of the fragile state of polar regions, where the decline of iconic species and melting ice are seen as emblematic evidence of the effects of climate change (O'Neill, 2022). Despite the wider recognition of the importance of polar regions, the subject is underrepresented in high school curricula, and awareness is lacking among some teachers (Gold et al., 2021). A survey of ~25,000 US students found that their "polar knowledge proves to be very low" (Pfirman et al., 2021). Some programmes have been set up to heighten students' awareness, such as the NSF-funded High School Polar Ambassadors Program (Turrin, 2023). Resources are available for teaching polar science in the classroom (Zicus, 2010). However, providing more direct experience of polar regions is very challenging. The high cost of travel to polar regions and, indeed, the environmental impact of travel is a formidable obstacle for students to participate in on-site learning in the Arctic and Antarctic.

On the other hand, the increasing availability of the internet via satellite, even in remote parts of the world, opens new, previously unimaginable opportunities for teaching by videoconference. This, in combination with online teaching having become more acceptable due to the COVID–19 pandemic, raises the question of whether live teaching by polar researchers is a viable option to improve and enhance learning. The presence of faculty in remote polar regions offers unique opportunities to deliver established and polar-related teaching content live via videoconference to students in lecture theatres and classrooms not only at the home institutions, but anywhere in the world.

In this paper we present examples of a well-established experiential pedagogy, variously referred to as place-based 'authentic learning' (France et al., 2019), 'the real classroom', in what has been described as 'teachable moments' (Zembylas, 2016), or 'real world learning' (Morley and Jamil, 2021). Opportunities also exist for school students to participate in arctic and subarctic research (Klütsch et al., 2021). These approaches to teaching bring 'the outside in' (Schlager et al., 1996), which can provide students with a more meaningful and engaging learning experience of an environment that would otherwise be inaccessible. This approach also allows for an interest in live interaction with researchers with whom students can identify or even project themselves into their future civic engagement or research work, potentially encouraging future careers in Arctic disciplines.

The present study was based upon the expedition of FCK, KG and SK3 to Pond Inlet in northern Baffin Island, Nunavut, Canada in early spring 2023. The population in this community of the High Arctic, the third northernmost settlement in Canada, is >90% Inuit. During the expedition, the team was involved with live teaching at institutions in the UK, USA, France and Germany. The work presented here was part of the Scottish Government funded project "Environmental sustainability of the Inuit community of Pond Inlet at the Northwest Passage"[1].

Methods

The team (FCK, KG and SK3) resided in the Environment Canada Research Station in Pond Inlet from 20 March – 15 April 2023 (Fig. 1). Internet was available through the modem available in the Research Station and by cellular network / mobile phone hotspots. In both cases, the connection was provided by Qiniq, a regional telecommunications provider launched by SSi Canada. The Qiniq WiFi provided at the research station averaged a download speed of 2–5 Mbps and an upload speed of 0.3–1 Mbps. Overall, 12 lectures / sessions were delivered (Table 1).

[1] https://arctic.scot/members-research-spotlight-environmental-sustainability-of-the-inuit-community-of-pond-inlet-at-the-northwest-passage/

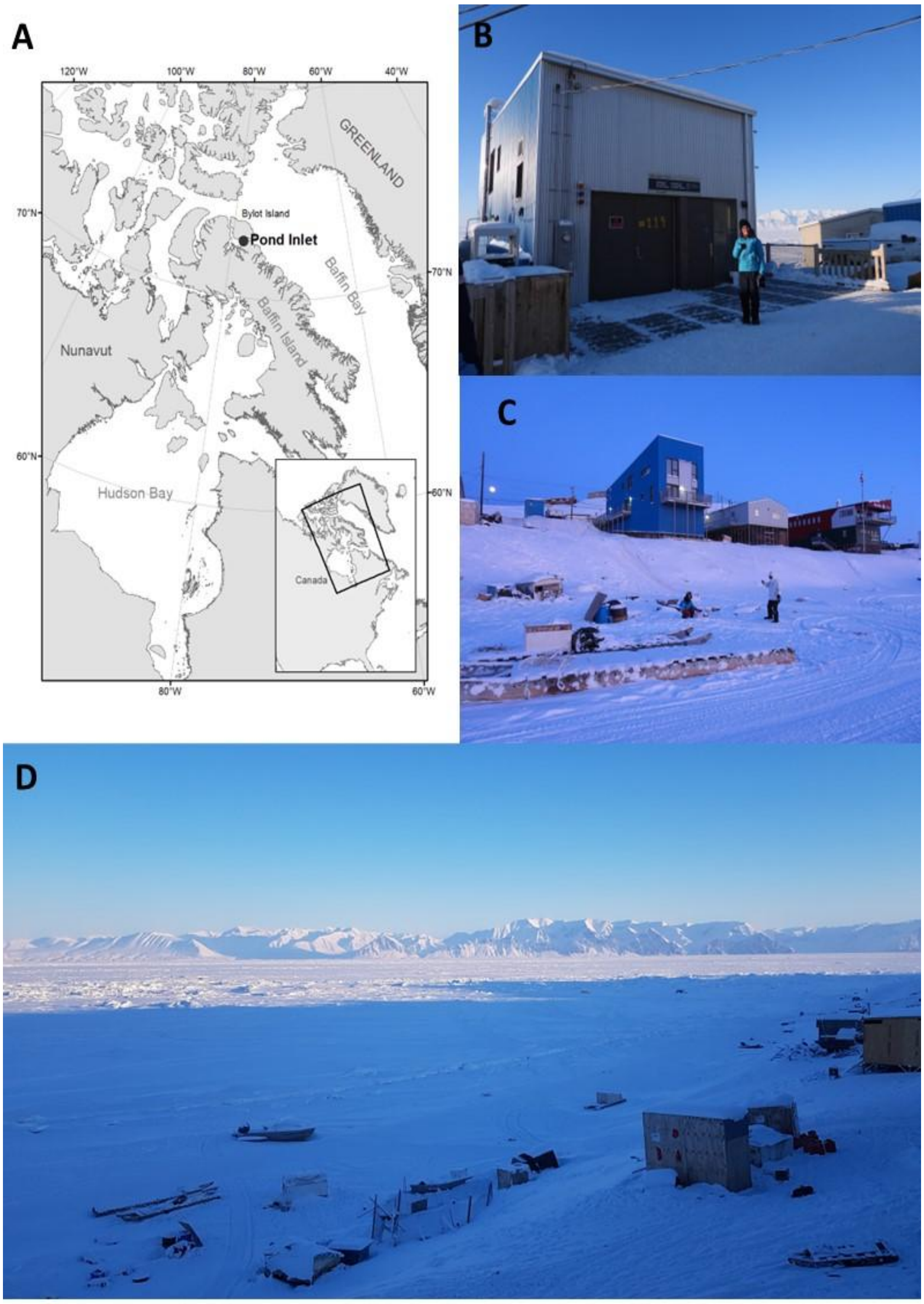

Figure 1: Pond Inlet, Nunavut. A. Geographical location. B, C. The Pond Inlet Research Station (B: view from the shore road; C: view from the frozen sea surface – the Research Station is the large building in the centre). D. Panoramic view from the upper level, which corresponds to the background behind the lecturer during the videoconferences described in this paper.

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Date	Title	Lecturer(s)	Course coordinator	Target audience / Course code	Duration Hours
University of Aberdeen					
23 March 2023	Plant life in the Arctic	FCK & KG	MB	2nd year undergraduates / BI25P4	1
27 March 2023	Mangroves	FCK	IPS	2nd year undergraduates / BI25Z5	1
30 March 2023	Seagrasses	FCK	IPS	2nd year undergraduates / BI25Z5	1
31 March 2023	Polar biodiversity and climate change	FCK	IPS	2nd year undergraduates / BI25Z5	1
Lycée International de Valbonne					
3 April 2023	Polar biodiversity and climate change	FCK	OD		1
ASGSG					
29 March 2023	Polar biodiversity and climate change (1 of 2)	FCK	BG, BV & LW		1
31 March 2023	Polar biodiversity and climate change (2 of 2)	FCK	BG, BV & LW		1
University of Massachusetts, Amherst, USA					
13 April 2023	Soaring with the Butterflies	SK3	(University of Massachusetts)	MBA Students at the Isenberg School of Management	1.5
Start Up Company Founders, USA					
21 March 2023	Master Mind Session	SK3	NewChip		2
29 March 2023	Master Mind Session	SK3	NewChip		2
4 April 2023	Master Mind Session	SK3	NewChip		2
5 April 2023	Master Mind Session	SK3	NewChip		2

Table 1: List of teaching activities delivered from Pond Inlet in the Canadian Arctic

Findings

Overall, the March–April 2023 expedition to the High Arctic of Nunavut, Canada, showed in five case studies that thanks to developments in videoconferencing / teaching software and better internet connectivity due to lower earth orbit satellites even in the remotest areas on Earth, online live teaching in classrooms and lecture theatres in Europe and the USA have become a viable option which did not exist a few years ago.

Case studies

The case studies included 12 different teaching events, covering scheduled teaching at the University of Aberdeen, the University of Massachusetts and NewChip, as well as participatory research for high school students at LIV and ASGSG, respectively.

University of Aberdeen, Scotland, UK: Regular teaching content

FCK delivered online lectures for two courses for 2nd year students at the University of Aberdeen from the Arctic: BI25P4, Plants, People and Environment (Coordinated by MB) and BI25Z5, Fundamentals in Marine Biology (Coordinated by IPS). To avoid unforeseen failures, the video link via Microsoft Teams was first trialled between Pond Inlet and Aberdeen on 22 March. The next day, FCK delivered the first live lecture, “Plant life in the Arctic” for 2nd year undergraduates of the University of Aberdeen (BI25P4). On 27 March, he gave a live lecture entitled “Mangroves” followed (BI25Z5), and finally a lecture about “Polar biodiversity and climate change” (BI25Z5). The latter was during daylight hours in Pond Inlet and held from the upper level of the Research Station, with the panorama of sea ice-covered Eclipse Sound and Bylot Island in the background behind the lecturer. The striking scenery helped to engage and enthuse the students, stimulating a lively two-way discussion after the lecture covering subjects including sea ice and the life of Inuit in this environment.

Student feedback from the “Plant life in the Arctic” lecture was very positive. Students commented on the uniqueness and the memorability of the experience:

> Student 1: “Truly unique, a different perspective into learning which was really engaging. I would certainly love to see more of these sorts of lectures”.

> Student 2: “Really fun actually! Remembered a lot of the info and the session I think because of how novel it was. Bragged to my family and friends about it and all. Really enjoyable”.

This is an example of the merit of a ‘teachable moment’ (Morley and Jamil, 2021). But, to be pedagogically valid, the remote delivery needed to be more than simply a teaching novelty or a pragmatic solution.

Students also valued the insights into how polar research is done:

> Student 3: "I thought getting to see what was being live in the field was like was incredibly interesting for me- for me it brought a human aspect to all the work that goes on behind studies, rather than just reading a paper".

This student reminds us that, although the published outcomes of polar research are readily accessible, readers should hopefully also understand the context and constraints of the research.

For the 'Plant life in the Arctic' lecture it is also worth noting that students appreciated the technological achievement involved in the delivery:

> Student 4: "…I liked how he was able to point the camera right out the window to show us the area he was telling us about (Fig. 1D). I think this showcases how technology continues to improve education and learning."

> Student 5: "Receiving lectures live from the Arctic… demonstrated how far technology has come, but also revealed its limitations".

Students welcome an improved understanding of remote working, but also are grateful when teachers make the most of available technology to communicate new insights. The lectures were recorded in MS Teams and made available to the class via the Blackboard virtual learning environment (Blackboard is a part of Anthology, Reston, Virginia).

Albert Schweitzer – Geschwister Scholl Gymnasium (ASGSG), Marl, Germany: Participatory research

Prior to the expedition, FCK and EA had held two interactive sessions by videoconference with students and teachers (BV, BG and LW) and both EA and BV had prepared a website each[2]. FCK gave a two-part lecture entitled "Polar biodiversity and climate change", enhanced by a slideshow about snowmobile field trips of the team (FCK, KG, SK3 with local outfitter David Sukslak) to Utuk Lake and Cape Hatt (the latter was the study site of the 2009 expedition (Sayer et al., 2013, Küpper et al., 2016)). on 25–26 March. The two sessions were held during daylight hours for both locations (Nunavut and Germany, respectively) from the top floor of the Pond Inlet Research Station, with a panoramic view of the frozen Eclipse Sound and Bylot Island behind the speaker. The first lecture was broadcast onto the big screen in the main assembly hall of the school (ASGSG) and simultaneously to the eTwinning partner school, Liceo Machiavelli in Rome, Italy. Students in both Germany and Italy took part and they had prepared questions for FCK too, which gave the live teaching a pan-European scope. The second lecture was made available to the wider community of the school in Germany, including parents.

[2] https://padlet.com/eleniavramidi/project-title-environmental-sustainability-of-the-inuit-comm-hmdkv3lh9t5067nw
and
https://padlet.com/v1b1/arctic-expedition-xfmsyiuu4nw60fu2

Figure 2: FCK's live lectures with Albert Schweitzer – Geschwister Scholl Gymnasium, Marl (Germany, A) and the Lycée International de Valbonne (France, B)

Lycée International de Valbonne (LIV), France : Participatory research
The videoconference on 3 April between FCK and a *Première* class (11th grade) of scientific teaching (Students aged 16–17) was carried out during Life and Earth Sciences lessons at the Lycée International de Valbonne Sophia-Antipolis (France). It had been integrated into the *Premiere* programme in the part *2.2. The terrestrial radiation balance, greenhouse effect, albedo and impact of the melting of the sea ice on the albedo*. After studying the greenhouse effect, albedo, radiative forcing, climate modelling and different climate scenarios (RCP-Referent Climate Pattern), the videoconference allowed students not only to see live images of sea ice, but also to discuss climate-change effects on sea-ice loss and their social and economic consequences related to the loss of the sea ice. Life and Earth Sciences programmes in France are designed in a systemic way in order to take into account, in an integrated manner, all facets of a question like climate change. This meets one of the objectives of the programme of *Première*: Understand the nature of scientific knowledge and its methods of development[3].

Videoconferencing was introduced with the screening of the film *Immersed in the Arctic*[4], filmed during the previous expedition to the area in which OD and FCK had worked, showing a complete lack of sea ice cover in July 2009. Videoconferences and exchanges which were able to take place with the researcher and the views of the ice cover shown live, constituted resources for the development of educational activities contextualised around the notions of albedo and its amplification. Integrating videoconferencing into the educational approach has allowed conceptual teaching to be reinforced/complemented with otherwise inaccessible real-world scenarios. Students' reactions to the videoconference were of several types in relation to different issues:

- **fascination**: to witness live an actual testimony which uses the real codes of social networks but in a school setting. "It's extraordinary to be able to interact with a scientist who is currently studying climate change in the Arctic, it makes us more real, more concrete." Videoconferences can be a means of raising awareness and inspiring students to understand how knowledge is created, using key real-world examples that they are unable to interact with personally.
- **projection into studies**, or even for a scientific profession: some students reacted to this testimony by asking if students could go to the Arctic, or if for researchers, expeditions of this type were frequent and easy to arrange. Clearly, the students, after hearing the testimony, identified themselves with polar scientists. Such videoconferences can be a vector for promotion and engagement in professions relevant to global warming (scientist/politician/lawyer).
- **frustration** and desire to be in the researcher's place: some students also expressed their frustration, such as "Nice for him if it is fun to go to these regions", or "Going to these regions is bad for the carbon footprint, and promoting it is counterproductive." These reactions should not be ignored; it is

[3] https://www.education.gouv.fr/sites/default/files/ensel806_annex.pdf
[4] https://www.youtube.com/watch?v=MOOsXBt58bs

the clearly argued rationale for and scientific knowledge and understanding gained from research in these regions which might win over the most sceptical people. As for pupils or students, they must not have the feeling of “abandonment” or “diversion” from the curriculum by the professor from their teaching mission towards them for personal research purposes. Videoconferencing must be a teaching method deliberately chosen for its advantages and not an alternative enforced by research commitments. If the content of the videoconference is an objective notional contribution to training, this feeling of frustration will be reduced.

– **reinforcement for climate-related commitment**: French students are committed to actions against climate change. Eco-delegates are mechanisms for recognizing students’ engagement in Education for Sustainable Development (ESD) and the E3D label (Establishment in Sustainable Development Approach) included in the French National Education curriculum encourages actions focused on the ESD commitment. Student eco-delegates use the knowledge and understanding gained from teaching sessions to develop a rationale for their own actions to mitigate climate change (clean walk/ mobility challenge/ waste challenge/ school COP simulation, etc.).

Students were unaware of the technological challenges of setting up these videoconferences. Technological progress in communications and smartphones makes these communications truly trivialised for students, natural, but with a black box effect which increases as technical progress progresses. OD had already obtained this type of testimony in 2004 with their classes, such as the live monitoring of the Clipperton expedition of the French explorer Jean-Louis Etienne. The students could communicate with the explorer via a satellite link and even transmit experiments to be carried out by his team on site. Our students were thus able to compare the chemical composition of sea water with the water from their river. At that time, Internet communication, the very beginnings of cell phones and rudimentary satellite links were a technical feat and part of the educational experience. The videoconference was of high quality, allowing a faithful rendering of the filmed landscape for an authentic immersive experience. The technical aspects linked to this videoconference were also addressed following the videoconference as part of an objective of the *Première* programme: Method of developing scientific knowledge and evolution of techniques.

Entrepreneurship Lectures for NewChip: Regular teaching content

During the period of the study, SK was advising start-up companies from around the world via an accelerator called NewChip. SK had Zoom video lectures on Tuesday, 21 March from 14:00-16:00 EST, Wed March 29th from 11:00-13:00 EST, Tuesday April 4th from 11:00-13:00 EST, Wed April 5th from 12:00-14:00 EST. He also had a Zoom lecture for a class at the University of Massachusetts on Thursday, April 13th from 10:00 to 11:15 EST. These calls totalled 9 hours and 15 min. All of these lectures were given with high-resolution video via Zoom (Zoom Video Communications Inc., San Jose, California) and had no interruption. The lectures performed for NewChip are always performed via Zoom, therefore, the only difference for these lectures was the background scenery. The participants from around the world were fascinated and enthralled by the spectacular views from the team's home in the Pond Inlet Research Station. The first 10 minutes of these sessions were a discussion about the Arctic and highlights of recent fieldwork by SK and FCK. The overall experience was enhanced by the unique location. It sparked better engagement from the worldwide participants.

University of Massachusetts, Amherst MA, USA: Regular teaching content
Around the time of the present study, SK presented annually to a group of about 150 students in the Isenberg School of Business. This lecture has always been performed in person. This was the first lecture done via Zoom from a remote location. The introduction via the University of Massachusetts professor for SK elicited sounds of shock and awe due to the live broadcast scenery. This lecture was always evaluated by the students immediately afterwards. The lecture has been performed for over 10 years, so there is substantial data regarding the impression of the lecture. There was no perceivable difference in the grading of the lecture from the in-person vs via live broadcast from the Arctic.

Stakeholder engagement

On 6 April, as a case of engagement with local government stakeholders, FCK also held a 30-minute videoconference with the Mayor of the City of Marl, Germany, Werner Arndt, discussing aspects of polar climate change and life in a remote, mostly indigenous community with an emphasis on municipal management and primary and secondary education.

Rewards

It is evident from student feedback that there was good engagement with the lessons/lectures delivered from the Arctic. Students acquired discipline-centred knowledge and understanding in Arctic geography, biology, and culture. The students also gained important insights into the opportunities (as well as challenges) that polar scientists experience.

The technology also allowed audiences to ask questions in real time, so the interactive nature of the sessions promoted engagement from students, and a sense of being 'included' in the Arctic experience.

Part of the appeal of the 'real world' learning opportunities described in this paper is their innovative approach, creating a memorable and enduring experience (Morley and Jamil, 2021). We suggest that novel teaching experiences might well 'live on' in students' thinking and understanding.

The use of 'real world learning' has distinct possibilities when the focus is on remote places. For the Arctic, there are new opportunities to learn about the effects of climate change from visiting and resident scientists, from new field courses, and from Inuit knowledge holders (Jamal, 2023). Their insights can now all be communicated back in live feeds, blogs and other communications. This is inclusive because it provides potentially important opportunities for students whose mobility is restricted by geographical or economic constraints, and for students with disabilities.

Challenges

The most significant challenge remaining at present is the intermittency and cost of internet access in the Canadian Arctic. All 25 communities in Nunavut are dependent on satellite-based connectivity with slow speed and data gaps (Lochead, 2023a).

A videoconference requires in the range of 1–3 GB hr^{-1}, depending on video resolution and number of participants. This was a challenge since the monthly allowance of the Qiniq modem at the Pond Inlet Research Station was used up within 3 days of arrival. Further packages of 10 GB of data had to be purchased at a cost of Can$ 68.25. At times, the Pond Inlet Research Station was without internet access altogether: on two such occasions, the Hamlet of Pond Inlet (on 22 March) and the Sauniq Hotel (on 27 March) helped out by allowing FCK to give lectures from their premises.

Broadband access and affordability may improve in the future for Nunavut territory with connection to low-earth orbit (LEO) satellite systems such as StarLink™ which is currently available in some remote areas in the Canadian Arctic. This system offers faster connection speeds and unlimited flat-rate internet access to subscribers. There is increasing demand for these standards of service in remote communities in the Canadian Arctic. Galaxy Broadband Communications Inc., in partnership with OneWeb, also aims to offer LEO based internet services for businesses in all communities of Nunavut (Lochead, 2023b). LEO internet systems provide connections with less latency, due to the proximity of satellites to the ground and enable minimal time delays on connectivity. However, issues of concern related to LEO satellites can be space traffic, increasing space debris and light pollution obstructing views of astronomic interest in the night sky (Damjanov, 2017), but remote teaching arguably makes up only a marginal fraction of LEO satellite internet use.

Northwestel Inc., the Canadian telecommunication company that is the incumbent local exchange carrier in Nunavut, maintains that fibre optic connection is the best internet network technology in terms of reliability, affordable access, and consistency (Flynn, 2021). In June 2022, the Government of Nunavut released a request for proposals to connect Nunavut to the internet via the undersea fibre cable “Kattittuq Nunavut Fibre Link” connecting Iqaluit NU Canada with Milton, Newfoundland (NL), Canada. The fibreoptic cable was to be jointly funded by the Government of Canada and Nunavut and was scheduled to enter service in 2025. However, it was subsequently cancelled due to excessive cost (Tranter, 2023). The establishment of a fibre-optic cable network requires an extensive track of underground cables, which in the Arctic or Sub-Arctic particularly may damage sensitive habitat. An environmental impact assessment should therefore be conducted diligently to ensure that environmental and societal effects of the development are minimised. Also, in shallow waters, iceberg scouring is an inevitable issue in polar regions, which can lead to cable ruptures.

Currently, satellite-based internet services are used by people living in Nunavut, with Inuit comprising about 86% of the population in 2016 (Statistics Canada, 2016), to improve their educational, economic, social, and cultural opportunities. However, low internet speed and data limitations are barriers for those doing university work, using it for online family gatherings, and professional needs and may impact access to scientific knowledge, technological innovation, cultural expression, and political participation. Since the Inuit population in Nunavut is very young on average (57% under the age of 25 in 2016), adequate and affordable internet service in Nunavut is vital to empowering communities in this territory economically and educationally.

Teaching from polar regions can be challenging at times when polar research and teaching responsibilities are combined. Differences in time zones mean that the educator might have to compromise rest or valuable field work time to accommodate this discrepancy and avoid scheduling conflicts. Pond Inlet (GMT-5) was five hours behind Aberdeen (GMT), six hours behind Marl and Valbonne (GMT+1) and in the same time zone as Massachusetts (GMT-5). In these cases, careful scheduling of lectures was crucial to successfully proceeding with research and teaching responsibilities in the same day, on one occasion resulting in the lecturer holding a class at 06:00 local time Pond Inlet. However, time spent in polar regions is often limited, and it is important to plan carefully and decide whether to prioritise teaching commitments over adequate data collection and scientific rigour. Ultimately, it is a matter of how successfully the scientific objectives of the polar expedition can be met whilst at the same time providing opportunities for relevant external engagement activities.

Conclusions

The experience of the recent expedition to the Canadian Arctic clearly shows that online communication, including live teaching, is now a viable option for scientists working in the Arctic. It allows academics to offer students at their home and partner institutions worldwide unprecedented opportunities for new interactive teaching and learning experiences, accentuated by the unique circumstances of the Arctic environment, while reconciling teaching obligations at their home institutions with research expeditions to the Arctic. The experience is more effective as these conferences focus on a problem studied in class in the programmes and where live videoconferencing with a researcher represents a new element of confrontation of ideas and construction of knowledge. For secondary education, the challenge is to find the integration, and not the juxtaposition, of videoconferencing in learning. Upstream (preparatory) and downstream (operational) work make it possible to make the most of these videoconferences.

As experienced by the authors of this paper, the rewards (all on the teaching side) significantly outweigh the challenges (almost all of which are technical). It is hoped that online teaching will become firmly embedded in the work of scientists working in remote polar locations.

Such teaching could be used to inspire a new generation to better understand and value the Arctic. Communication technology can of course also be used by Arctic researchers to communicate more directly with the wider public, whose understanding and support is essential for polar science.

What we have described in this study is an innovative and possibly novel way to communicate polar science in realtime. The five case studies that we have described provide evidence that Arctic researchers can connect in a live and meaningful way with different audiences. We anticipate that advances in technology will allow Arctic researchers to move from novel and uncertain communications with students into an approach that becomes more routine and reliable, and still being exciting and inspiring.

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