

Interdisciplinary research centres as a research-based education platform: An exploratory study of the Digital Earth initiative

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1. Introduction

We are reporting on our two-year study designed to investigate how research centres can serve as platform for bringing research and education on Digital Earth closer together. It is a research project with a disciplinary root in the academic field of higher education studies, drawing together a wide range of research areas including academic profession, higher education leadership and management, higher education pedagogy, and philosophy of education. The primary motivation of our study is to better inform the development of relevant science and higher education policies for addressing the United Nation's Sustainable Development Goals (SDGs) - by investigating synergies between research and education associated with Digital Earth in Japan as a context. The significance of Digital Earth lies in its inherent interdisciplinary links between social and natural sciences, and its complex interface between research, education, outreach and policymaking - all of which are central to deciphering the interconnectivity between the 17 SDGs. Our study is therefore not only directly relevant to policymakers and university leaders interested in the evolving Japanese higher education landscape but also to educators and researchers working on advancing the SDGs through higher education around the world.

Our overall objective is to develop case studies for capturing and analysing the diverse range of examples of research-education synergies at three levels: people, internal partnerships and external interfaces. In particular, we study i) academics who have developed a portfolio of SDGs-related research and education responsibilities in different types of universities in Japan, ii) internal partnerships in research-education initiatives aligned with SDGs, and iii) partnerships with external stakeholders for advancing SDGs. As an exploratory investigation, we take a wider view of what constitutes a research centre - an organisational structure that supports research and inquiry activities. This working definition allows us to capture a more diverse range of academics, internal partnerships, and engagement with external partners.

2. Methods and data

Our research, which has been developed and conducted over the course of a two-year period (2018-20), consists of three interlinked work packages designed to collect complementary qualitative data for addressing the overall objective of the study. The main data collection activities involved field studies carried out in two academic visits to a diverse range of Japanese higher education institutions in 2019 and 2020. The qualitative data from the three packages are thematically analysed and synthesised in line with the questionnaire, documentary analysis, narrative and ethnographic methods used in educational research (e.g., Cohen et al 2017). The three work packages are interconnected for addressing the objective - as the research findings from each component can be triangulated for building a more holistic understanding of the key stakeholders and their partnerships beyond the confines of specific research centres or initiatives.

Work package 1: Linkages between the academic profession and SDGs

We used questionnaires as an instrument to study academics engaged with research-education activities aligned with SDGs and the Digital Earth agenda in Japan. The questionnaire was designed to understand the scope of their academic activities, with a focus on the following dimensions:

- Research-education synergies (e.g., Brew 2006, Healey and Jenkins 2009)
- Working with students as partners (e.g., Healey et al. 2014, Matthews et al. 2018)
- Intersectionality between research-education synergies and working with students as partners (Tong et al. 2018)

In order to capture the complexity of the academic professions and identities, we studied 12 academics with a diverse range of experiences and backgrounds by taking into account the following:

- Research- or education-focused institutions;
- Academic responsibilities and priorities in the research-education spectrum;
- Career stage (early-career academics to full university professors); and
- Engagement with academic outreach activities.

We have also analysed documents to complement the data from the questionnaires. Our work involves using i) publicly available databases containing the published research work and education-related outputs for understanding the range of academic activities aligned with the Digital Earth initiative and SDGs, ii) publicly available academic career profiles for identifying academic priorities and responsibilities in the research-education continuum. For developing an analytical framework for understanding key actors, stakeholders and enablers in the organisation structures, we carried out two academic visits to two internationally leading research centres of higher education studies in Japan (Hiroshima University and Hyogo University). Interviews with experts in higher education management and leadership were conducted for establishing links with the existing higher education models of Japanese universities (e.g., Arimoto 2014).

Work package 2: Internal partnerships in research-education initiatives aligned with SDGs

We have collected ethnographic data in order to develop case studies in order to provide context-rich data for studying how academics develop organisational structures and provide different forms of leadership within their institutions for their SDG-aligned initiatives. More specifically, our case studies aim to shed light on how:

- student-staff partnerships are valued, challenged and enacted in inquiry-based activities;
- research and teaching priorities are embedded in undergraduate research projects;
- education and outreach activities are incorporated in research group structures;
- cross-departmental research and education initiatives are promoted; and
- strategizing and implementing international-facing initiatives.

Work package 3: External partnerships in research-education initiatives aligned with SDGs

The main goal is to investigate the interface between academia and external stakeholders such as policymakers, members of local communities and international communities. We have adopted a novel approach in collecting qualitative data from leading experts in external partnerships and promoting the integrated research-education approach to SDGs at the same time: two high-profile sessions on the external partnership for advancing SDGs have been organised (an Education Session at the American Geophysical Union Fall Meeting 2019, and a Union Session at the Japan Geoscience Union-American Geophysical Union Joint Meeting 2020). Invited speakers from both sessions have been invited to reflect on the challenges, opportunities and impact of their leadership experience.

Data from the conference presentations provide information to address the research objective.

3. Key findings and conclusions

Here we highlight the conclusions from this study based on the key findings from the three work packages of the study. Academic papers are being prepared at the time of writing this report.

Key finding 1: There is a generally positive perception of research-education synergies and student-staff partnerships for advancing SDGs but challenging contexts for implementation persist.

The two major forms of synergies in the higher education system, namely functional (i.e. research-education nexus) and human resources (i.e. student-staff partnerships), were positively perceived by the 12 academics from a wide range of institutions, experience and disciplinary backgrounds. Most academics in our study have shown a clear understanding of the benefits of research-education nexus but only a relatively small number of the academics could articulate the specific synergistic linkages in their own practice. The following quote from an experienced research professor in this study underscores the contextual challenges in a competitive research environment:

As a professional researcher, he/she has to demonstrate good publication records to be accountable to funders, and society in general. Research development through synergies with education... could be difficult.

In terms of student-staff partnerships, all academics expressed favourable views of the underpinning values of work partnerships between academics and students. However, there were significant concerns about the structural challenges confronting the academics - as exemplified by the following quote from one education-focused professor in our study:

「真に対等な学生—教員のパートナーシップ」が成立したケースは極めて限られています。博士課程に進学した学生であっても、多くのケースでは「指導する教員」と「指導を受ける学生」という非対称な構造が存在していました。

From our documentary analysis, there is no obvious relationship between the level of academic experience and the number of outputs with clearly identifiable elements of research-education nexus and/or student-staff partnerships. However, the type of institution may have a significant influence on the synergistic practices. It appears that teaching-oriented institutions may view outreach and public engagement as an important platform for bringing the functions and people in their universities together. This observation is consistent with Professor Akira Arimoto's model that there has a growing dichotomy in the Japanese higher education system - an established trend towards the German research-oriented model whilst smaller private universities are becoming more teaching-oriented. More in-depth analysis is warranted as there is considerable complexity behind these higher education trends.

Key finding 2: A diverse range of research-education initiatives demonstrate Japanese academics' commitment to advancing specific SDGs within disciplinary contexts.

Our data shows that research-education nexus has been implicitly embedded in different disciplinary and institutional contexts. This is somewhat surprising as most academics in this study could not clearly articulate specific examples of such nexus and are aware of the contextual challenges.

Here is a summary of the five case studies that clearly demonstrate alignment with SDGs:

- A community-engaged inquiry-based learning initiative in a regional institution showcases a highly sophisticated and sustainable organisational structure that foregrounds students as partners as an educational approach. (SDG 11: Sustainable cities and communities)
- A final-year research dissertation module in a national university highlights the commitment to promoting SDGs across the sciences and social sciences. (SDG 11: Sustainable cities and communities; SDG 12: Responsible consumption and production)
- A disciplinary research consortium in a research-intensive university has an integrated educational programme with associated evaluation strategies. (SDG 4: Quality Education; SDG 13: Climate action)
- A university-wide sustainability science communication module with inquiry-based components in a research-intensive university highlights the significance of an interdisciplinary approach to undergraduate education. (SDG 4: Quality education)
- A high-profile sustainability initiative hosted by an international institution with a headquarter in Japan reveals the complex interplay between institutional strategic priorities at global and regional levels. (SDG 6: Clean water and sanitation)

Despite the contrasting contexts, all five initiatives in our case studies address clearly identified disciplinary areas directly linked to one or two SDGs - with relatively little emphasis on the interconnectivity between SDGs.

Key finding 3: Japanese academics show clear commitment to advancing SDGs through developing leadership in public engagement.

The following six invited talks at the JpGU-AGU Meeting (now postponed to July 2020 as a result of the global pandemic) will shed light on the two themes that are crucial in understanding the academia-community interface for advancing the SDGs. These six case studies with the follow-up interviews will be important for understanding the experts' own perspectives as academic leaders and evaluating their commitment to research-education synergies.

Theme 1: Developing external partnerships for research-education synergies

- Public engagement and policymaking (Shimizu 2020)
- Engaging with stakeholders and researchers (Nakamura 2020)
- Engaging with local communities (Fumiko Noguchi 2020)

Theme 2: Organisational leadership and management of large-scale initiatives

- International Geography Olympiad (Ida 2020)
- Use of multimedia platforms for an international audience (Barrett 2020)
- International Ocean Literacy Survey (Ichikawa et al 2020)

4. Acknowledgements

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