PTAS Project Report   (for REGULAR PROJECT GRANTS)

Project Title:

Coding Club – a peer-to-peer learning environment to surmount statistics anxiety and code fear

Project type (delete as appropriate):
B Innovation Project (introduction and evaluation of an educational innovation, usually taking a practical approach)

Principal Investigator: Dr Isla Myers-Smith - School of GeoSciences
Lead coordinator: Gergana Daskalova - School of GeoSciences, PhD student
Schools/department: School of GeoSciences

Team members (including Schools and Departments):
Dr Christopher Lucas - School of Informatics
Dr Kyle Dexter - School of GeoSciences
Dr Albert Phillimore - School of Biological Sciences
Dr Christina Coakley - School of GeoSciences
John Godlee - School of GeoSciences, PhD student
Dr Haydn Thomas - School of GeoSciences, PhD student
Dr Sandra Angers-Blondin - School of GeoSciences, PhD student
Dr Pedro Miranda - School of GeoSciences, PhD student
Samuel Kellerhals - School of GeoSciences, Undergraduate student
Claudia Meca van den Berg - School of GeoSciences, Undergraduate student

For further details, please contact: Dr Isla Myers-Smith (isla.myers-smith@ed.ac.uk)

Coding Club Website

https://ourcodingclub.github.io/

PTAS Report

1. What did you do?

Summary
With support from PTAS, we developed the Coding Club initiative (https://ourcodingclub.github.io). The emphasis of Coding Club is on acquiring skills in a non-threatening and supportive environment, and on developing life-long learning so that students can progress with their statistical and coding education beyond their degrees. Our project aims were to: 1) extend our open-access platform for quantitative online learning, 2) organise cross-disciplinary networking events and workshops for ecologists, statisticians and informaticians, and 3) provide comprehensive training in statistics and programming for students and researchers in the Schools of GeoSciences, Biological Sciences at the University of Edinburgh and beyond.

Coding Club has successfully continued beyond the scope of the PTAS funding period and continues to run with weekly online workshops, >40 open-access online tutorials and a free self-paced online course that we developed as a follow-up to our PTAS project with DataLab funding (https://ourcodingclub.github.io/course). We have also established an assessed course called Data Science in Ecology and Environmental Science (https://datascienceees.github.io/) in the Ecological and Environmental Science Programme at the University of Edinburgh. Coding Club website has received over a million pageviews from countries around the world since it was established in 2017 and currently reaches around 50 000 users per month.

Coding Club Content
Coding Club is advancing knowledge in the programming language R, which is the most widely used tool in ecological analysis and is also easily transferable to other disciplines, such as data science, informatics, economics, mathematics, statistics, chemistry, social sciences and more. During our PTAS funding period, we recruited PhD students who created Python tutorials more often used in disciplines such as earth sciences and physics and thus exceeded our initial aims by providing workshops and tutorials in R, Python as well as JavaScript and the Google Earth Engine. Over the course of our project, we followed a team approach to leading workshops and creating teaching content which was very well received.

The Coding Club Team
Gergana Daskalova was the lead coordinator of Coding Club and Isla Myers-Smith was the lead member of academic staff and over the course of the two years of PTAS funding, the Coding Club team extended to also include six undergraduate students and seven PhD students who all either led in-person workshops or created online content. All of the workshops were free, they happened weekly during semester time and represented a friendly environment in which people could be both learners and teachers. We also organised five workshops across other universities in the UK and shared our teaching model which has led to the creation of Coding Clubs in other institutions. Coding Club continues to grow and over its five years has included over 25 undergraduate students and 15 PhD students as core team members. It is exciting to see the Coding Club Team continue to grow with all members excited to learn quantitative skills and share those skills with their peers.

2. What did you find out?

Coding Club was an initiative designed to overcome code fear and statistics anxiety. Code fear is the fear of programming and statistics anxiety is the worry about a lack of quantitative skills. Through the peer-to-peer teaching initiative, attendees are trained in quantitative skills by PhD and undergraduate students and then mentored to share these skills to their fellow students through a series of informal workshops on a variety of quantitative skills topics at different levels. By designing and running this initiative over the past five years, we have learned an incredible amount about how students learn and engage with quantitative skills and in particular how to encourage a greater diversity of participation in quantitative subjects.

3. What have been the benefits to student learning?

We have found that students who feel empowered, able to independently learn the subject matter, who feel confident with reaching out to peers to ask for help and to teach skills themselves, go on to see quantitative learning as a journey that they will carry out across their careers. These students see greater opportunities for themselves in quantitative disciplines, but also have greater confidence overall to apply for jobs and put themselves out there for opportunities that they previously would not have considered. We have seen recent graduates of Coding Club and our data science course go on to careers in data science, demonstrating that quantitative skills can reshape future career paths.

4. How did you disseminate your findings?

We have disseminated the Coding Club model of teaching quantitative skills as well as information about our in-person and online workshops in a variety of ways to increase audience read. Within the University of Edinburgh we used mailing lists as well as newsletters and messages on Learn pages. We also put out posters around King's Buildings and the Main Library area. We often got participants from other schools like the School of Biological Sciences, School of Informatics as well as students and staff members from the fields of linguistics and economy. Over time, word of mouth also spread about our initiative. We also received further visibility by winning an Edinburgh Impact Award for the Best Student-Staff Collaboration in 2017 and were highlighted as part of the #InspiringStudents campaign.

Because all of our teaching materials are freely available as online tutorials, they are accessible to people beyond the University of Edinburgh and we used social media to reach an international audience. Our dissemination was particularly effective via Twitter (https://twitter.com/our_codingclub) and our account has 3,688 followers which people frequently retweeting the links to our tutorials or sharing their positive experience.

We wrote two blog posts for the University of Edinburgh Teaching Matters blog:

We have documented what we have learned about how to teach quantitative skills through a number of blog posts and through university-level teaching symposia and committees.

In 2016, we summarised our findings of what works and what doesn't in the teaching of quantitative skills on the University of Edinburgh Teaching Matters blog: https://www.teaching-matters-blog.ed.ac.uk/coding-club-a-positive-peer-to-peer-learning-community/

In 2017, we talked about our Coding Club activities including our 2017 University of Edinburgh Impact Award for best student-staff collaboration: https://teamshrub.com/2017/04/10/coding-club-goes-to-aberdeen-and-the-impact-awards/

In 2018, we charted the progress of Coding Club and discussed students as learners and teachers on the Student Experience Grant website: https://www.ed.ac.uk/student-experience-grants/success-stories/inspiration-corner/coding-club

In 2018, we presented our approach to peer-to-peer teaching at the College of Science and Engineering workshop on assessment in the sciences in a workshop entitled "Advancing quantitative skills peer-to-peer – the Coding Club model.". The presentation included academic staff (Myers-

Smith), PhD students (Daskalova and Angers-Blondin) and undergraduates (Meca and Kellerhals) illustrating the cross career stage approach to the Coding Club model.

In 2018, we summarised how to overcome the fear factor in teaching and learning quantitative skills in a blog post on the Dynamic Ecology blog:
https://dynamicecology.wordpress.com/2018/10/25/guest-post-coding-club-trying-to-overcome-the-fear-factor-in-teaching-and-learning-quantitative-skills/

In 2018, we also led a workshop at the Ecology Across Borders conference of the British Ecological Society which focused on sharing our Coding Club teaching model and how to transfer quantitative skills among scientists. We created a dedicated tutorial as a product of our workshop that has been accessed more than 20 000 times:
https://ourcodingclub.github.io/tutorials/tutorials/

In 2019, we wrote another blog for Teaching Matters where we specifically addressed how to build confidence using peer-to-peer teaching:
https://www.teaching-matters-blog.ed.ac.uk/coding-club-building-confidence-using-peer-to-peer-teaching/

In 2019, the Coding Club team was featured in the "Your Impact" newsletter in an article entitled "Coding with confidence" and Gergana Daskalova was interviewed for the University of Edinburgh Edit Magazine.

In 2020, we outlined some of our thinking on how personal journals can be reshaped by quantitative skills training on the Dynamic Ecology blog:
https://dynamicecology.wordpress.com/2020/03/16/guest-post-personal-journeys-towards-developing-quantitative-skills/

We also wrote and maintain a page on our website that describes how people can get involved with Coding Club, how they can start their own Coding Club or develop online data science tutorials.
https://ourcodingclub.github.io/involve

Over the PTAS period, we led five workshops in collaboration with our colleagues from universities across the UK, including at the University of Glasgow, University of St Andrews and University of Aberdeen. These workshops were an opportunity for our model of teaching quantitative skills to reach a broader audience and were very well received, with participants making remarks like "I have learned more coding in a day than over my whole PhD". Often the people who attended our workshops were then inspired to continue using our online tutorials and meet as a group later on and continue learning.

5. How could these benefits be extended to other parts of the university?

We have engaged with college-level committees on the resources and approaches for the teaching of quantitative skills, engaging particularly those based in the School of School of Physics and Astronomy. Through her role as the Student Rep on the College Research Training Committee, Gergana Daskalova has further shared insights from Coding Club with those involved in quantitative

training from other schools. We would be keen to further contribute to college- and university-level engagement on teaching innovation particularly in the area of developing quantitative skills.

Since the PTAS funding period, we have developed an assessed course as a part of the Ecology and Environmental Science degree programme that is open to third and fourth year students and masters students from across the university called Data Science in Ecology and Environmental Science (https://datascienceees.github.io/). This course that stems out of Coding Club takes an innovative approach to learning and assessment. We focus on collaborative coding and project management in addition to quantitative skills to replicate the real-world of professional data science. Students are assessed on their engagement and individual contributions to group work and feedback provided to fellow students and how they incorporate feedback provided to them by their peers and the teaching team, rather than solely on the quantitative skills being taught. The course is taught through the platform GitHub, which is the globally dominant version control software used in the fields of Data Science and the tech industry in general, providing highly transferable skills to real-world workplaces.

We capitalised on the development of our initiative during our PTAS funding period to apply for further funding provided by the DataLab to build an online course called Data Science for Ecologists and Environmental Scientists as a part of the Coding Club online platform. This bespoke MOOC across three course themes introduces learners to key elements of data science - 'Stats from Scratch', 'Wiz of Data Vis' and 'Mastering Modelling'. The 16 individual tutorials that make up the course in addition to the further 25 tutorials hosted by Coding Club allow learners to create their own bespoke learning pathway to gaining key skill sets. Quizzes and challenges test knowledge, but also allow users to join a larger community of learners and gain confidence in their own skills.

We have now secured funding from the E4 NERC Doctoral Training Programme to continue Coding Club into the future and will explore funding options that can support the initiative through undergraduate teaching budgets and postgraduate training budgets, so that the initiative is sustainable over time.

We hope to continue to develop the Coding Club initiative and to contribute further to the development of quantitative training across the University of Edinburgh and beyond.

Coding Club Web Statistics

Statistics for the Coding Club website during the PTAS funding period (2018 – 2019):

- 269,673 users
- Average 12,000 monthly users
- 498,199 page views
- 13% returning visitors
- Top countries are US, UK, India, Canada, Germany, Australia, France, Netherlands, Brazil and Spain with audience extending to >100 countries in total

Statistics for the period following the PTAS funding (2020 – Jan.2021):

- Returning visitors increased from 13% to 16.1%
- Users increased by 23%
- Pageviews increased by 50%
- The number of countries from which our online audience comes remained unchanged (~170, including island countries), but our audience increased in all of the countries, sometimes up to 10-fold.

Promotional Information

Quotes from past and current Coding Club members:

"Coding Club opened up a new exciting world of Data Science to me. Without the tutorials it would have never been that friendly or positive entrance into the world of coding that helped me to get this far. I am looking forward to all the opportunities and discoveries that can come from the skills I learnt."
Dani Gargya, University of Edinburgh BSc Ecological and Environmental Sciences 4th year student

"Coding Club has completely shaped my academic and personal life. Before Coding Club, I never thought it would be possible for me to learn any technical computing skills, let alone enjoy it. From the welcoming environment, the clear instructions and applications, I was able to learn quickly and enjoy it! Becoming a tutor further solidified my newfound knowledge and brought me joy - it is great to see how quickly Coding Club can turn people from being completely uncomfortable by coding to confident. I cannot recommend it enough - there is no better time like the present to help answer pressing environmental questions with data and statistics!"
Izzy Rich, University of Edinburgh BSc Ecological and Environmental Sciences alumna

"I don't think I realised just how much Coding Club played an integral role in shaping my academic life until I graduated. Coding Club offers a unique learning environment in a transdisciplinary and non-hierarchical setting. This allowed me to develop skills which I have put to a surprising amount of good use, first in my job, and now in my postgraduate degree."
Claudia Meca van den Berg, University of Edinburgh BSc Ecological and Environmental Sciences alumna

"Coding Club has given the quantitative and technical skills to pursue challenges that I always thought were beyond my scope of abilities and inspired me to continue to learn and share."
Shawn Schneidereit, University of Edinburgh BSc Ecological and Environmental Sciences 4th year student

"Coding Club has led me through a tumultuous educational journey, empowering me to become a data scientist and to help others overcome their coding anxieties."
Anna Chirumbolo, University of Edinburgh, BSc Ecological and Environmental Sciences 4th year student

"If the thought of coding, data, and statistics makes you break out in a cold sweat, Coding Club is the place to go!"
Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"If you are intimidated by the thought of learning to code, Coding Club is the place to go!"
Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"When I first came to Coding Club, I had no coding experience and was pretty intimidated learning it from scratch! My coding anxiety was quickly busted and I found Coding Club to be super clear and enjoyable. They have a great selection of tutorials for beginners, and more involved topics to get stuck into as your skills improve. The ecological examples they use to explain things really helped ground me when I was tackling more abstract coding concepts like statistical modelling and data manipulation. Because coding club is peer

based, things are explained by people who understand what it is like to be in your shoes. It's the difference between having a friend explain something to you or reading it from a textbook."

Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"Because of Coding Club, I now have a suite of great data skills (R, Java Script, Github, & more). These skills were super valuable when I was applying for conservation and ecology jobs. I am now an intern for the Cairngorms National Park where I am mapping woodland using remote sensing. Every week I use the data skills Coding Club taught me to explore, analyse and present my data."

Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"I am by no means a coding expert, but Coding Club taught me how to approach data problems by myself and gave me the confidence to explore and learn more about data science."

Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"Competence in data science is a great addition to environmental knowledge and it's a skill set many employers are looking for. The data skills I learnt helped me stand out to employers when searching for jobs in conservation."

Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

"Coding club can teach you really valuable data science skills that will take your research to the next level."

Cameron Cosgrove, University of Edinburgh BSc Ecological and Environmental Sciences alumnus

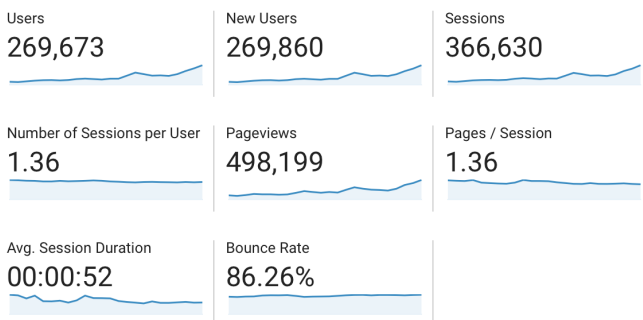*Promotional photographs:*
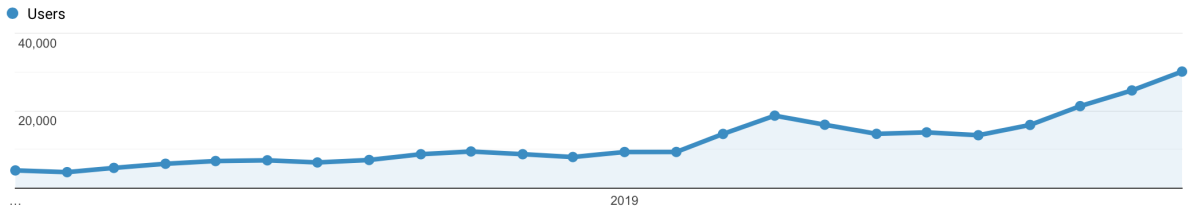
Institute for Academic Development
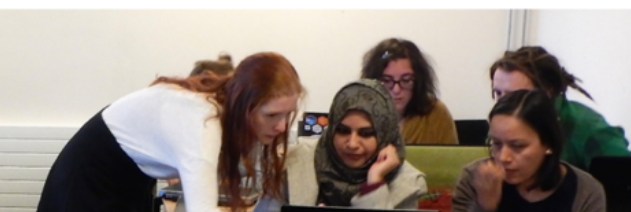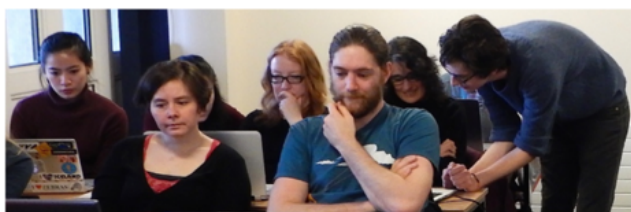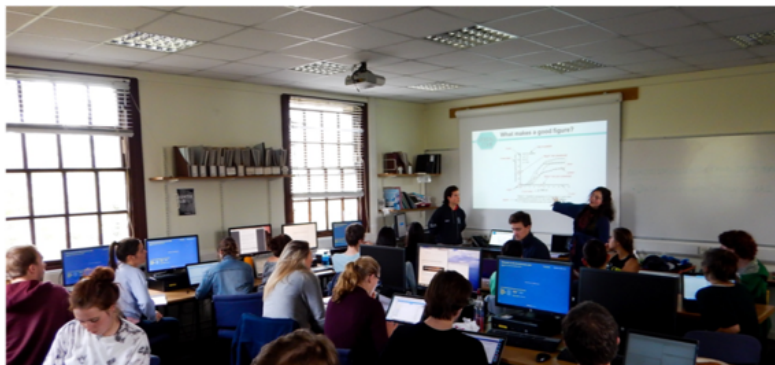
Web Statistics:

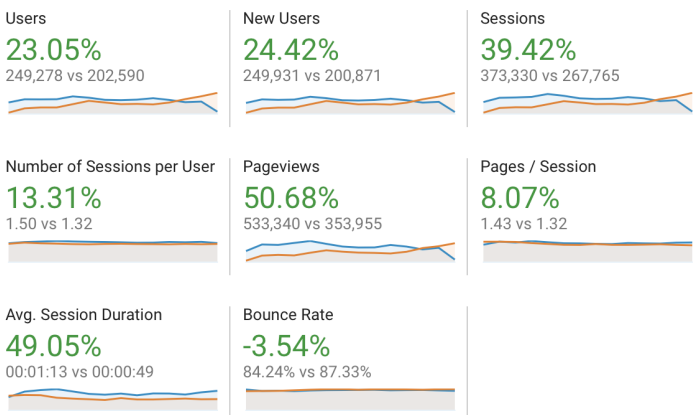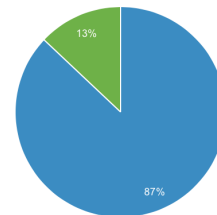Maps of Coding Club online audience during the PTAS funding period (2018 - 2019):
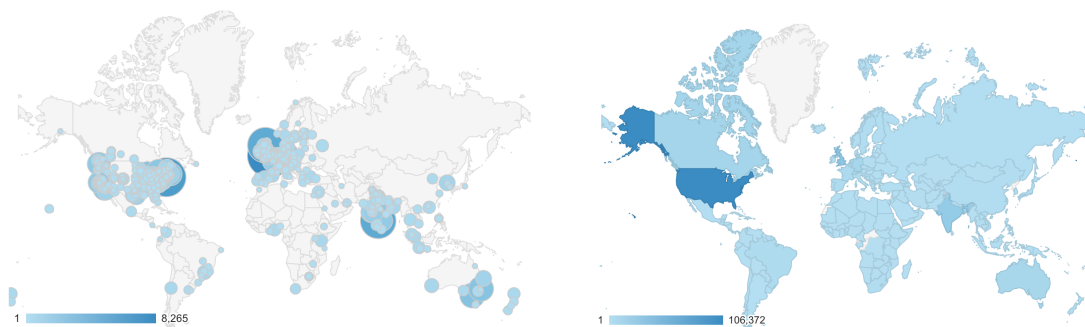
Top countries for online visitors:

	Country	Users	% Users
1.	United States	106,372	39.16%
2.	United Kingdom	29,934	11.02%
3.	India	24,570	9.04%
4.	Canada	11,423	4.20%
5.	Germany	11,016	4.06%
6.	Australia	8,869	3.26%
7.	France	5,742	2.11%
8.	Netherlands	5,537	2.04%
9.	Brazil	4,039	1.49%
10.	Spain	3,653	1.34%

Users

40,000

20,000

...   2019

Users	New Users	Sessions
269,673	269,860	366,630

Number of Sessions per User	Pageviews	Pages / Session
1.36	498,199	1.36

Avg. Session Duration	Bounce Rate
00:00:52	86.26%

New Visitor ■ Returning Visitor

13%
87%

Users	New Users	Sessions
23.05%	24.42%	39.42%
249,278 vs 202,590	249,931 vs 200,871	373,330 vs 267,765

Number of Sessions per User	Pageviews	Pages / Session
13.31%	50.68%	8.07%
1.50 vs 1.32	533,340 vs 353,955	1.43 vs 1.32

Avg. Session Duration	Bounce Rate
49.05%	-3.54%
00:01:13 vs 00:00:49	84.24% vs 87.33%

New Visitor ■ Returning Visitor

Jan 1, 2020 - Feb 4, 2021

16.1%
83.9%

Nov 26, 2018 - Dec 31, 2019

13%
87%

Jan 1, 2020 - Feb 4, 2021: ● Users
Nov 26, 2018 - Dec 31, 2019: ● Users

40,000

20,000

... | March 2020 | May 2020 | July 2020 | September 2020 | November 2020 | January 2021

The University of Edinburgh
Principal's Teaching Award Scheme

Jan 1, 2020 - Feb 4, 2021: ● Pageviews
Nov 26, 2018 - Dec 31, 2019: ● Pageviews

Jan 1, 2020 - Feb 4, 2021: ● Pageviews
Nov 26, 2018 - Dec 31, 2019: ● Pageviews
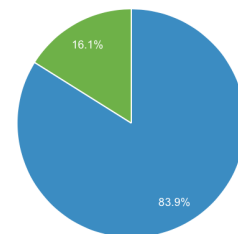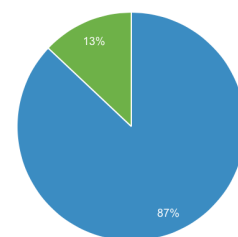
Jan 1, 2020 - Feb 4, 2021: ● Users
Nov 26, 2018 - Dec 31, 2019: ● Users
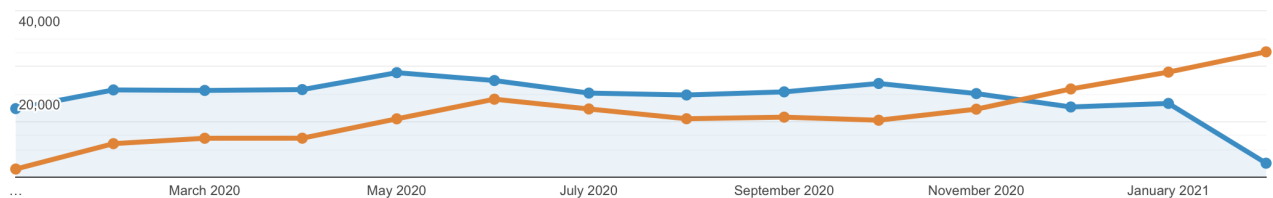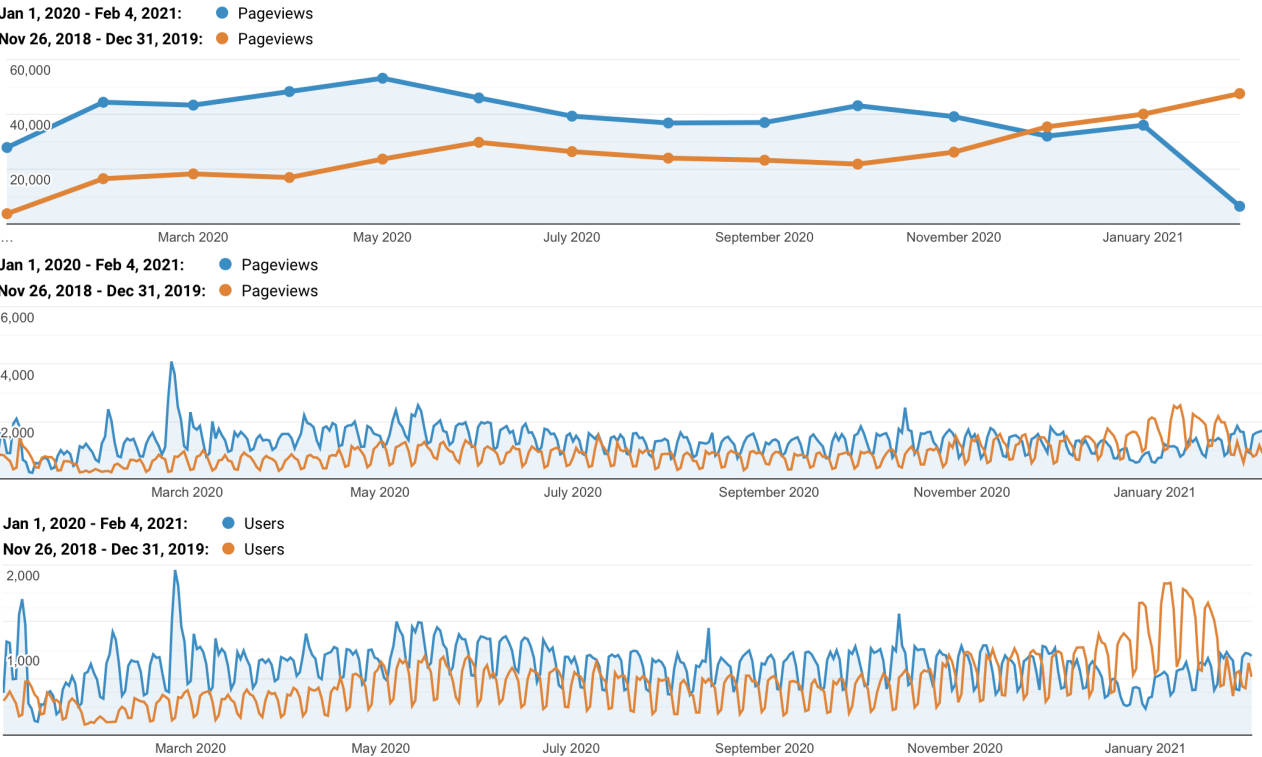
1.	/2017/03/15/mixed-models.html	89,817	(8.30%)
2.	/	82,024	(7.58%)
3.	/2016/11/24/rmarkdown-1.html	57,146	(5.28%)
4.	/tutorials/mixed-models/	55,932	(5.17%)
5.	/tutorials/	52,678	(4.87%)
6.	/tutorials/pandas-python-intro/	50,748	(4.69%)
7.	/2018/04/18/pandas-python-intro.html	46,645	(4.31%)
8.	/2017/02/27/git.html	40,197	(3.72%)
9.	/tutorials/pandas-time-series/	29,059	(2.69%)
10.	/tutorials/fortran-intro/	26,631	(2.46%)
11.	/2019/01/07/pandas-time-series.html	26,605	(2.46%)
12.	/tutorials/git/	25,978	(2.40%)
13.	/tutorials.html	24,227	(2.24%)
14.	/2017/04/26/time.html	19,893	(1.84%)
15.	/tutorials/rmarkdown/	17,293	(1.60%)

● Users

Top Channels

- Organic Search
- Direct
- Referral
- Social
- Email
- (Other)
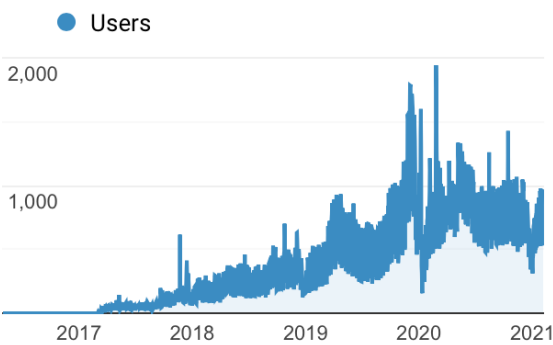
84.3%

10.3%

Users

Users

2,000

1,000

2017 2018 2019 2020 2021
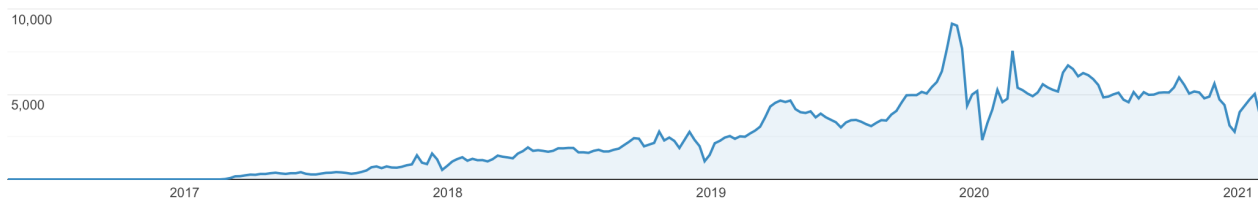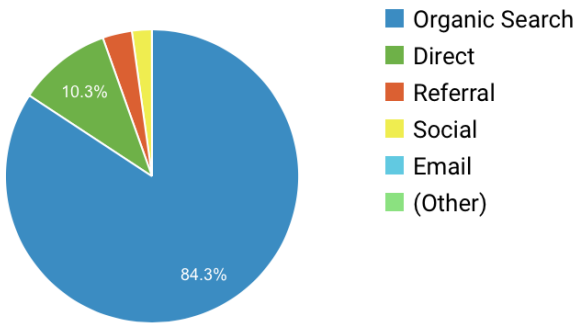
Financial statement (please delete as appropriate):

This project has utilised the funding awarded to it by the PTAS adjudication committee and the Principal Investigator or School Administrator appropriate can provide financial statements showing the funding usage as and when required by the UoE Development Trusts who may require it for auditing purposes.

We used our funding to pay content creators, to build our web platform and to run in person Coding Club workshops.

The contact for the School of GeoSciences finance administrator is Lisa Thorburn (lisa.thorburn@ed.ac.uk) who can provide the financial information about the specific financial statemetns for our PTAS funding.

Please send an electronic PDF copy of this report to:
Email: iad.teach@ed.ac.uk