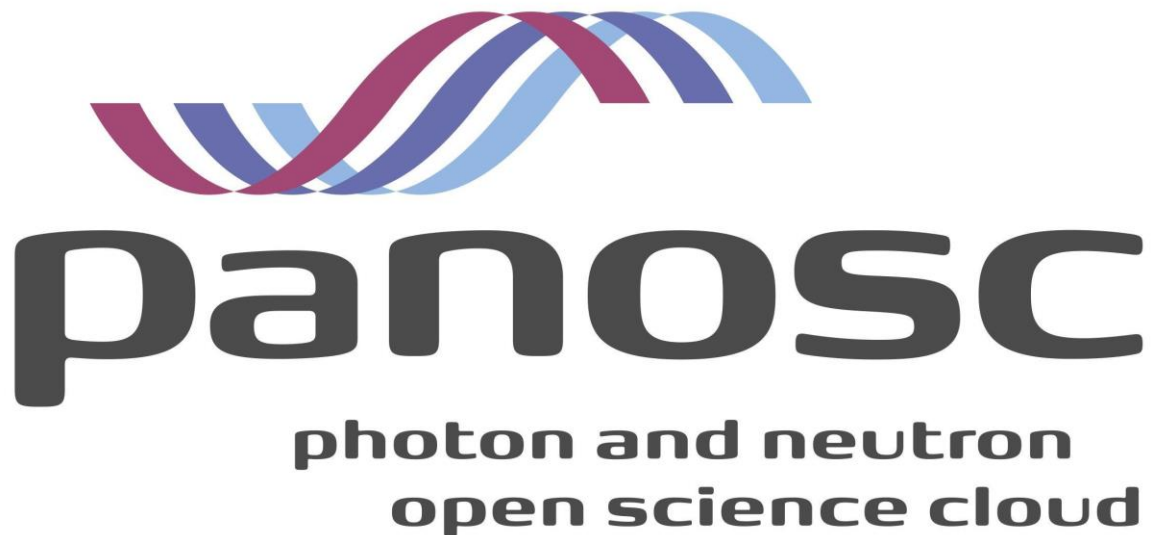


PaNOSC
Photon and Neutron Open Science Cloud
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Deliverable D8.2: Lessons learned and future prospects for adopting the e-learning platform pan-learning

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2	Institut Laue-Langevin (ILL)	France
3	European XFEL (XFEL.EU)	Germany
4	The European Spallation Source (ESS)	Sweden
5	ELI European Research Infrastructure Consortium (ELI-ERIC)	Belgium
6	Central European Research Infrastructure Consortium (CERIC-ERIC)	Italy
7	EGI Foundation (EGI.eu)	The Netherlands

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Introduction

This report constitutes PaNOSC Deliverable D8.2: *Report on lessons learned and future prospects for adopting the e-learning platform at the PaNOSC facilities, task 8.4*

Where task 8.4 sounds:

A workshop will be prepared and held during the project to foster uptake of the e-learning platform by the PaNOSC beneficiaries. In the workshop, the participants will be trained in using the platform for developing both passive and interactive training material for their own teaching. Mentoring to developers of training material will be provided subsequently to the workshop. During the mentoring phase new functionality from Task 8.2 and Task 8.3 will be introduced. Likewise, the mentoring phase will be used to retrieve feedback on usability. Besides providing a service to the PaNOSC facilities, this task is also seen as an important step to ensure the sustainability of the e-learning platform. A report covering lessons learned from the workshop and mentoring phase and with an outlook to the future will be delivered (D8.2).

The report will start with a status for the PaNOSC provisioned e-learning platform to form the background for lessons learned and future prospects.

Status

The PaNOSC provisioned e-learning platform, usually referred to as pan-learning, is fully operational and in operation. It can be accessed at <https://pan-learning.org>. In this section a status update is given for its technical capabilities, the outcomes from a Train-the-Trainers workshop, and its usage.

Technical status and functionality of pan-learning.org

A recent status report for the e-learning platform at <https://pan-learning.org> was given in the 4th mid-year summary in the form of Deliverable D1.9. Here it is sufficient to highlight that <https://pan-learning.org> is now a component of the joint training portal for the photon and neutron scattering community that can be found at <https://pan-training.eu>. Consequently <https://pan-learning.org> now redirects to <https://e-learning.pan-training.eu>. Nonetheless, in this report we refer to the e-learning component as pan-learning.

Pan-learning consists of three components:

1. Moodle: a widely used open source learning management system (<https://moodle.org>).
2. A wiki for pure text material
3. Jupyter notebooks or remote desktops that can be linked and executed from moodle courses.

The latter point is one of the major technical achievements in WP8. Another technical achievement is the integration of UmbrellaID so that users who already have an Umbrella account can readily access the training platform, incl. pan-learning, without signing up. UmbrellaID is the PaNOSC endorsed method for federated authorization and authentication to the PaNOSC partner facilities and will give users readily access to all PaNOSC partner facilities.

In principle it should be possible to run Jupyter or remote desktops at compute infrastructure in a different site than the one hosting pan-learning. However, so far we have not succeeded with this due to issues related to authentication.

Workshop & Task 8.4

As previously reported in Deliverable D1.7, we held a two-part online workshop February 9th-11th and on March 23rd-24th, 2021, organized by the Department of Science Education, University of Copenhagen, specifically Prof. Jesper Bruun. All teaching material used at the

workshop can be found on the ESS indico page.¹ The workshop had 31 registered participants (learners) from 11 photon and neutron sources and one university (DTU, a PaNOSC observer). With the exception of XFEL, all PaNOSC partners were represented. ISIS@STFC, DESY, Elettra, HZDR, and SOLEIL represented ExPaNDS, where the two latter are responsible for the corresponding training work package, WP5, in ExPaNDS. HZB also had a participant in the workshop. It is worth noting that about half of the registered participants were from either ESS with six participants or ISIS@STFC with nine participants. The third largest contributor was ELI with three participants.

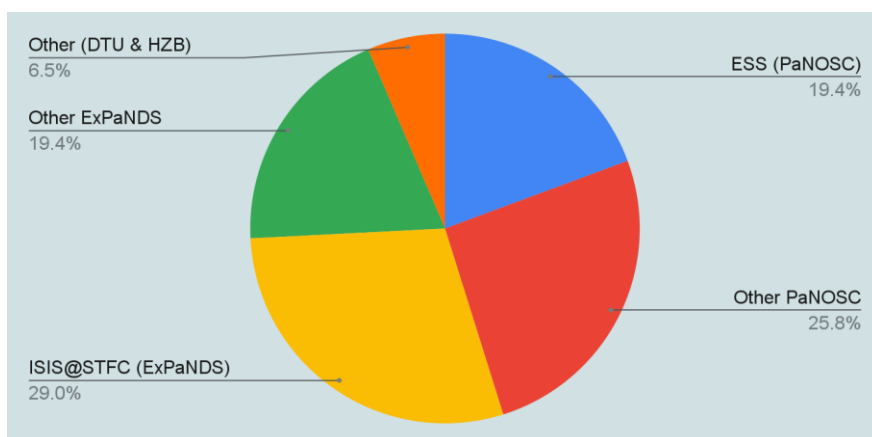


Figure 1. Distribution of participants' affiliations among the 31 participants at the Train-the-Trainers workshop.

It is remarkable that the biggest contributor in terms of number of participants is the neutron source ISIS@STFC, because, although ISIS@STFC is an ExPaNDS partner, they are not participating in the training package. However, ISIS@STFC played a major role in the SINE2020 work package where e-neutrons.org was (further) developed by co-developing courses specifically for ISIS@STFC together with the work package leader. Hence, this activity prior to PaNOSC may be regarded as the seeding ground for the subsequent engagement of ISIS@STFC in pan-learning.org.

Outcome from the workshop

The workshop was divided in two parts with the purpose to let participants develop material for pan-learning in the interim period. 17 new courses (cf Table 2) have been created in the course of PaNOSC. Out of these (only) five can be traced back to the Train-the-Trainers workshop and are contributed by either ISIS or ESS. In addition to those, several courses in construction can also be traced back to the Train-the-Trainers workshop. From conversation with some of these course creators it is clear that there is still a desire to complete the creation of those courses but for the time being the creators are not able to prioritize this

¹ <https://indico.ess.lu.se/event/2499/overview>. The schedule can specifically be found at https://indico.ess.lu.se/event/2499/attachments/10985/18435/PaNOSC_TtT_workshop_DRAFT_schedule.pdf

work relative to their day-to-day tasks. In this regard it should be noted that, whilst all PaNOSC partners have some resources allocated for WP8, none of the participants, with the exception of ESS and ELI, are committed in the grant agreement to provide training material. That being said, ESRF has since contributed a course created by staff that did not participate in the Train-the-Trainers workshop.

Subsequent to the workshop, Jupyter notebooks were uploaded to the training platform so they are available in pan-learning.org. Some of these are the result of MS8.5: *e-learning virtual facilities* and these notebooks are not yet available for external users. However, ESS and Vrije Universiteit Amsterdam have based workshops / courses on Jupyter notebooks accessible from pan-learning, where the pan-learning (moodle) functionality was used to enroll students. Further as detailed below, both University of Copenhagen and TU Delft routinely make use of moodle- and wiki-based material in their respective neutron scattering courses.

ESS has in PaNOSC provided assistance to staff who wished to upload notebooks or create courses. This has been vital for getting these courses created and made available for students. It particularly requires expertise and extensive testing to make sure that specific computing environments work as intended for Jupyter and remote desktops and ensure they continue to work when code is changed.

Moreover, as reported in Deliverable D1.7 & D1.8 we do see an increased interest in using pan-learning.org (e.g., from the Open Reflectometry Standards Organisation (ORSO, <https://www.reflectometry.org>) and European Neutron Scattering Association (ENSA)) and the workshop resulted in several improvements to moodle.

Usage and statistics

User statistics

From moodle we can get information about registered users' names, emails, and time since first login. We have used that information for the following analysis.²

From the analysis we find that Pan-learning had 707 registered user accounts as of May 23rd of which 644 have unique registrants behind them. Out of these registrants, 172 have only registered but never logged in. Hence, we can presume that pan-learning has 472 regular unique users, which we here will refer to as 'active users'. This does not mean that hundreds of users use the platform on a regular basis, but rather that hundreds of users have signed up at some point and as a minimum poked around. Most likely in the context of a workshop using pan-learning or migrating from <https://e-neutrons.org> when that was closed down. We presume that many of the registrants that only have registered did so when migrating from e-neutrons.org when that was shut down.

Of the active users, 68 are using a private email for the account, mostly gmail which is used by 59 users and therefore also encompasses the most used domain name for email

² The analysis is based on anonymized user information in an excel spreadsheet, which has been analyzed with pandas in a Jupyter notebook. Both the spreadsheet and notebook can be found on github.

addresses among the users. If we ignore the private emails, we find that the 476 active users have at least 132 different affiliations originating from 31 countries. Out of the 476 active users, 93 are affiliated with a PaNOSC partner.

The statistic is summarized in Table 1 below for active users as well as for all registrants.

Item	Active users ³	All registrants
Number of accounts	476	648
Accounts using private email accounts	68	105
Number of affiliations	132	159
Number of countries	31	36
Number of accounts affiliated with PaNOSC partners	93	115
Affiliated with:		
ESS (incl. affiliate accounts ⁴)	57	75
ILL	14	18
ESRF	11	11
XFEL	5	5
ELI	3	3
CERIC	3	3

Table 1. Statistics for pan-learning user accounts.

Figure 2 shows the top 10 affiliations in terms of numbers of active user accounts. We note that six of the affiliations in top 10 represent neutron sources (ESS, TUD, ILL, STFC, ILL, FZJ, PSI) and that the high ranking of University of Copenhagen (KU) is due to a course on neutron scattering that runs on a regular basis. The top affiliation clearly associated with photon science is ESRF which comes in as number seven from the top with 11 active user accounts, however, TUD runs a course on both neutron and X-rays (photons), and the many Universiteit van Amsterdam (UVA) students have participated in a photon science course together with students from Vrije Universiteit Amsterdam (VU).

³ Users who have registered and subsequently logged in to moodle.

⁴ Many contributors to ESS (e.g., in kind partners from other facilities) have an ESS affiliate account.

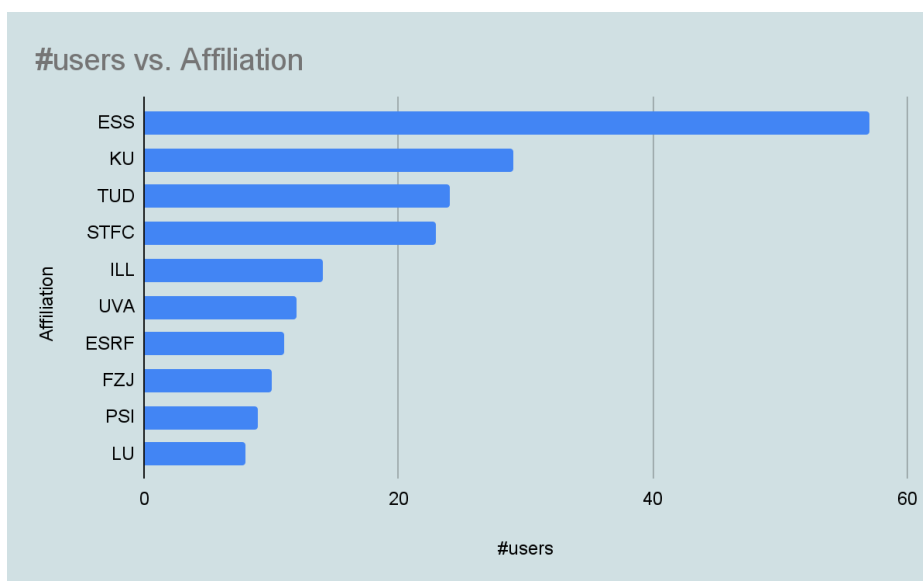


Figure 2. Top 10 affiliations for active user accounts at pan-learning.

Courses

Figure 3 shows how available courses are presented in pan-learning, whereas Table 2 shows user statistics and creators of new courses created during the course of PaNOSC.

Name	#participants	Creator
Introduction to Oasys (Hercules 2022)	19	ESRF w CERIC support
Introduction to Neutron Reflectometry Fitting	21	ESS
DMSC - Instrument Scientists workshop (2022)	27	ESS
Python Workshop (IKON21)	105	ESS
Python Workshop (IKON20)	113	ESS
SasView: Analysis of SAS Data	33	ESS
Including Jupyter Notebooks in your Course	24	ESS
Creating a Video Mini-Lecture	45	ESS
Collection of photon science slides	9	ESS
Quasi-Elastic Neutron Scattering	26	ISIS@STFC
Swedness Online 2021	55	ISIS@STFC
Muons in Semiconductors	5	ISIS@STFC
Muons in Magnetism	10	ISIS@STFC
Muons in Superconductivity	7	ISIS@STFC
Neutrons, X-rays and Positrons for studying microscopic structures and dynamics	26	TUD
Photosynthesis and Energy 2022	22	VU

Table 2. New courses in pan-learning, associated user statistics and affiliation of course creator.



The screenshot shows the pan-learning Moodle interface. At the top, there is a navigation menu with 'Catalogue', 'e-Learning', 'Events', and 'About'. A user status indicator in the top right says 'You are not logged in. (Log in)'. The main header features the 'Photon and Neutron eLearning' logo and a decorative graphic of a network with binary digits. Below the header, a welcome message states: 'Welcome to the e-Learning platform. This e-Learning platform hosts free education and training for scientists and students. Below you will find courses on both the theory of photon and neutron scattering and how to use python code or software for data reduction and modelling.' A search bar for courses is provided. The 'Available courses' section lists 20 courses, including 'Introduction to Neutron Reflectometry Fitting', 'Neutron Scattering Library', 'Introduction to Neutron Scattering', 'Advanced Topics in Neutron Scattering', 'Quasi-Elastic Neutron Scattering', 'Swedness Online 2021', 'Neutrons, X-rays and Positrons for studying microscopic structures and dynamics', 'Photosynthesis and Energy 2022', 'Introduction to Muon Spin Spectroscopy', 'Muons in Semiconductors', 'Muons in Magnetism', 'Muons in Superconductivity', 'DMSC - Instrument Scientists workshop (2022)', 'Introduction to Oasys (Hercules 2022)', 'Python Workshop (IKON21)', 'Python Workshop (IKON20)', 'SasView: Analysis of SAS Data', 'Including Jupyter Notebooks in your Course', 'Creating a Video Mini-Lecture', 'Collection of photon science slides', and 'Quiz Taster'. On the right side, there is a login form with fields for 'Username' and 'Password', a 'Remember username' checkbox, and a 'Log in' button. Below the login form are links for 'Lost password?' and 'Federated Log in'. Further down are sections for 'First time here?' with a 'Click to request an account.' link, 'PaN-Wiki' with a description of Wikipedia-style articles, 'Contact' with the email 'admin@pan-learning.org', and 'Funding' with a description of funding from the European Union's Horizon 2020 program and the European Union flag logo. At the bottom of the page, there is a footer with the Moodle logo and a funding notice: 'PaNOSC and ExPaNDS projects have received funding from the European Union's Horizon 2020 research and innovation program under grant agreements No. 823852 and No. 857641, respectively.'

Figure 3. Screenshot from pan-learning showing available courses.

We note that all the new courses are contributed by only five institutions and that most of these are contributed by either ISIS or ESS. Only two PaNOSC partners (ESRF and ESS) and one ExPaNDS partner (ISIS@STFC) have contributed courses. Moreover, two Dutch universities, of which one (TUD) also operates a neutron source, each contributed a course.

Lessons Learned

Below a number of lessons-learned are provided together with the data supporting those conclusions.

#	Lessons Learned	Supporting data
LL1	Creating courses require time and effort and is usually only done if some persons are allowed to prioritize it	Most courses are created for specific workshops where training material is needed. Only a few participants in the Train-the-Trainers workshop managed to create courses ready for use. Staff involved in PaNOSC but who have to prioritize day-to-day tasks have not contributed significantly.
LL2	Current setup and activities in PaNOSC has not enabled strong contribution from PaNOSC partners.	Only two PaNOSC partners have contributed courses so far.
LL3	Some users enroll despite not participating in workshops	We see users from more countries and affiliations than workshops can account for. Most affiliations only have one or two registered users.
LL4	Users come from many different countries and types of corporation (universities, companies, research organizations, research infrastructures)	This can be seen from the user statistics.
LL5	Having champions / expert users available is essential	All course creators have received assistance from ESS staff. Moreover, the significant contribution from ISIS can be traced back to their involvement in SINE2020 where they co-developed courses with expert users at University of Copenhagen.
LL6	It is more efficient to sell pan-learning to people with a specific need (such as an upcoming workshop) rather than evangelizing to a wider audience.	Participants in the Train-the-Trainer workshop, without a specific need, have not contributed significantly with course creations. Whereas, the opposite is true.
LL7	Most material is still neutron focused due to prior projects such as SINE2020. However, we do see an increase in x-	This follows from the analysis of courses.

	ray focused content, but only partly due to PaNOSC.	
LL8	The combination of Jupyter notebooks with moodle attracts new course creators.	Course creators who would use Jupyter notebooks anyway now use pan-learning for running the courses, often in a blended teaching fashion.
LL9	The full integration of Jupyter notebooks in moodle courses, where moodle is used to enrich the course (e.g. with quizzes), remains to be seen.	Existing courses either use Jupyter notebooks and only use moodle for enrolling students and possibly put the notebooks in context. Rich moodle courses do not make use of Jupyter notebooks yet.
LL10	The technology adopted for running Jupyter notebooks can be used more generally for running remote desktops from pan-learning and hence software that cannot be run in a Jupyter notebook	Demonstrated with the OASYS course by ESRF.
LL11	It requires expertise and extensive testing to ensure that compute environments for Jupyter and remote desktops work as intended and continue to work when code is changed	Based on experience with getting existing courses to run.
LL12	It is not straightforward to run the Jupyter notebooks on a different site than the moodle instance as it apparently may seem. Issues related to authentication need to be resolved. Currently, the pan-learning host (ESS) needs to be advertised in advance for compute intensive courses.	Based on an unsuccessful attempt to call Jupyter running at ESRF and experience from workshops.

Future prospects for adopting the e-learning platform at the PaNOSC facilities

Not surprisingly major factors for adopting the e-learning platform are time and need. Without prioritizing training and having dedicated staff at the facilities it is hard to see pan-learning being used in a wider context at the facilities. So far only ESS and ESRF among the PaNOSC partners have contributed courses and ESS and ELI are the only facilities with major resources in WP8 and ESRF was supposed to provide an Hercules course on OASYS anyway.

Hence, if funding should be received for a next round it is important that each partner is sufficiently resourced with dedicated staff and that they have a need upfront for providing courses or workshops. The Hercules school would be a good place to start.

It is noteworthy that ESS and ESRF are the only two PaNOSC partners with, to the best of our knowledge, dedicated staff for instrument simulations. They may therefore have an added interest in using the Jupyter technology for providing training material in such matters.

The pan-learning technology for running Jupyter notebooks (or remote desktops) is a strong asset that enables hands-on exercises on both scripting based (Jupyter) and GUI (remote desktop) in connection with a pan-learning course. This technology is used in several of the new courses created in the course of PaNOSC. The technology would benefit from being further developed to 1) make best use of both Jupyter and moodle - specifically, the transmitting of information between Jupyter and moodle would be a strong asset, and 2) enable the execution of compute demanding Jupyter notebooks or remote desktops to be run at compute infrastructure of the trainer's choice, so that the trainer can ensure that sufficient computing infrastructure (e.g., on-demand) is available for a course. Such a functionality will make it possible to create compute demanding courses which otherwise would not be possible and hence has the potential to attract new course creators.

We see that two universities have contributed material and that pan-learning has many users from outside the research infrastructures and from countries world wide. Hence, in a wider context if we continue to evangelize pan-learning, we expect to see an increased usage from corporations outside PaNOSC. This however requires that resources are dedicated to evangelize pan-learning at conferences, user meetings, etc.

Access to expert knowledge / champions, like ESS has provided in PaNOSC, is crucial. Hence, the creation of more champions seems to have the potential to accelerate adoption. The Train-the-Trainers workshop has not per se resulted in champions at all the PaNOSC partner facilities. Indeed, only ESS and ISIS courses can be traced back to that event despite the participation of 12 corporations, primarily research infrastructures. Rather it seems that the champions we now have out there are the ones who have created courses available for use. Hence, to create champions at a facility, an early-adopter with time and need is required at that facility. All that being said, the Train-the-Trainers workshop was run at the height of the COVID pandemic and it may therefore be worth running a new face-to-face workshop for a more direct and dynamic experience before rushing to conclusions.

Hence, in summary, in order to accelerate the usage of pan-learning:

- 1) Ensure champions and experts, including technical experts, are available for course creators.
- 2) Focus on trainers with time and need, preferably early adopters.
- 3) Improve functionality, specifically related to the integration of Jupyter and remote desktops and enabling external computing resources to be used.
- 4) Continue to evangelize pan-learning (e.g., at conferences and user meetings).