ORIGINAL ARTICLE

Imaging without Borders (IMAGINE): Democratizing MRI Access through Hands-on Low-field MRI Education

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Imaging without Borders (IMAGINE) summer school is a free 9-week hybrid training initiative designed to provide low-field Magnetic Resonance Imaging (MRI) hardware and scanner maintenance education to biomedical engineers, MR imaging personnel, and clinicians, with emphasis on closing the MRI hardware and engineering competencies in resource-limited settings. The program was delivered to 179 trainees from 33 countries, through an immersive curriculum that combines case-based and hands-on learning approaches to train teams of multidisciplinary learners to build their own low-field scanners and collectively train others. Here, we describe the curriculum and outcomes of two consecutive years of IMAGINE, including onsite constructions of 6 low-cost open-source preclinical (50mT) Halbach array scanners in Africa, Latin America, Southeast Asia, and North America. The design, components, assembly instructions, and field map tests of the scanners are reported to demonstrate their potential as promising MRI engineering education tools. A repository of all the necessary information to replicate the scanner is publicly available. With further scanner development, through future iterative training programs, IMAGINE can be an avenue for training the next generation of imaging innovators to create local low-cost MRI technology that will sustainably democratize diagnostic imaging and make it readily accessible to all.

KEYWORDS

Low-field MRI; MRI education; Open-source hardware; low-cost imaging; preclinical MRI; low-and-middle-income countries

1 | INTRODUCTION

MRI access inequality is motivated by a variety of factors - across infrastructure, economic resources, and others that span a lot further than just the physical availability of MRI scanners. An important component is medical professional training, where educational initiatives often primarily focus on radiologist and technologist training [1], including training opportunities in MRI data science, image post-processing, and AI [2]. While these components are essential, hardware development, maintenance, and troubleshooting remain comparatively underrepresented within MRI education frameworks [3], especially in low- and middle-income countries (LMICs), where biomedical engineering support remains limited, and device downtime is disproportionately high [4, 5]. Between 14% and 19% of donated medical equipment becomes non-functional in LMICs [6, 7], and according to the World Health Organization (WHO), up to 70% of donated medical devices are unusable when they arrive in LMICs [4]. Although device failures in these regions are attributed to insufficient maintenance capacity and incompatibility with local infrastructure, inadequate technical training is considered the leading contributor. Beyond capacity building, structured hardware training has direct implications for scanner reliability, safety, and reproducibility. Understanding gradient systems, radiofrequency (RF) chains, shielding, and system integration enables users to better diagnose performance limitations, reduce downtime, and interpret image artifacts in research and clinical contexts. Therefore, MRI scanner deployment without hardware capacity building is insufficient for sustainable imaging access.

In the last decade, low-field (LF) MRI hardware and reconstruction methods have advanced substantially, positioning it as a realistic, maintainable, and context-appropriate imaging solution [8]. Broader adoption requires en-

gineers and imaging professionals who understand the backend of MRI systems, not only clinical or computational interfaces. Several training opportunities have been proposed to close this gap, including LF-MRI build workshops [9, 10, 11, 12, 3]. These workshops have demonstrated feasibility on shorter timelines but often lacked opportunities to establish a strong foundational understanding, reproducible educational resources, and remain limited in LMICs. To address this, we developed a hybrid curriculum to train interdisciplinary teams in MRI hardware design, assembly, use, and troubleshooting. Our approach emphasizes structured preparation, open-access documentation, reproducibility, and the use of economically attainable components suitable for resource-constrained settings. This, as we demonstrated in this work, enables implementation of self-sustaining train-the-trainer models for rapid increase in local MRI hardware capacity. Here, we describe the curriculum and its outcome to offer one approach at closing gaps in MRI hardware education across all settings. Motivated by the near absence of preclinical MRI infrastructure across LMICs, particularly in Africa, which limits global biomedical research and innovation, we focused the training on skills and technology development for low-field preclinical MRI systems.

2 | METHODS

The training curriculum was developed and delivered through the Imaging Without Borders (IMAGINE) initiative of the Consortium for Advancement of MRI Education and Research in Africa (CAMERA), a European Society for Magnetic Resonance in Medicine and Biology (ESMRMB) working group. The IMAGINE Summer School is a free structured, hands-on LF-MRI open education program that translates foundational hardware knowledge into practical scanner-building and troubleshooting skills. The program is a multi-institutional collaborative efforts led by the McConnell Brain Imaging Center at the Montreal Neurological Institute (The Neuro), McGill University, Canada, in partnership with the Biomedical Research Institute, Stellenbosch University, South Africa; Center for Brain and Health, New York University, Abu Dhabi, United Arab Emirates; MRI Uganda, Mbarara University, Uganda; Institute for Biological and Medical Engineering and Biomedical Imaging Center, Pontificia Universidad Católica de Chile; and the Medical Artificial Intelligence Laboratory, Lagos, Nigeria. The program is open to all disciplines in imaging, was piloted in 2025 with parallel onsite LF scanner builds (build labs) in Canada and South Africa and expanded in 2026 to include four additional parallel onsite builds: Chile, Uganda, Nepal, and Nigeria, through the train-the-trainer model, described in detail below. This multi-site approach reinforced reproducibility, documentation, local sourcing of scanner components, and, more importantly, encouraged cross-site knowledge exchange, towards establishing a community for self-sustained troubleshooting and further scanner development. Below, we outline the IMAGINE program-specific aims, its pedagogical framework, program structure, delivery, and evaluation approaches. The preclinical scanners developed during the training program are also outlined. The program aimed to:

1. Build standard skills in MR hardware development and maintenance.
2. Upscale and advance the MRI knowledge of biomedical engineers, physicists, and imaging personnel practicing in resource-constrained settings.
3. Provide an experiential learning environment for the development of innovative imaging technology for resource-constrained settings.
4. Train and retrain local experts who will sustainably advance the practice of MRI in LMICs.
5. Create a collaborative culture and a network of imaging innovators in LMICs.
6. Contribute to reproducible open-science efforts of the global imaging community.

2.1 | Pedagogical Framework

The IMAGINE Summer School curriculum is based on RAD-AID's Teach-Try-Use (TTU) learning framework [13] and follows the CAMERA's hybrid case-based train-the-trainer delivery approach (Figure 1), by encouraging the most active trainees to return as trainers in subsequent years. This model supports sustainable program growth, reduces dependence on the original teaching team, and enables broader knowledge sharing through a growing, locally connected network of trainers and learners. This pedagogical framework has been described previously [1] and successfully implemented to train LMIC MRI technologists in advanced image acquisition best practices and imaging professionals in image processing [14] and AI applications [15]. For the IMAGINE training program, we combined the TTU framework with key steps in design thinking for new technology development (Figure 1) to provide three progressive modules: 1) an online self-directed foundation course (*Teach*) on hardware engineering tied to understanding (*Emphatize and Define*) concepts, challenges, and pain points of LF-MRI design and construction, including magnet design optimization, electronics, image acquisition and reconstruction for subsequent high-fidelity assembly of a low-cost rat brain system. 2) An onsite build lab (*Try*) to explore the new knowledge acquired in constructing scanner parts (*Ideate*) for reduced costs and assembly of functional prototypes. 3) Remote and onsite scanner performance testing (*Use*) to investigate homogeneity and signal acquisition fidelity (*Test*), document build and test materials, and create clear step-by-step instructions to train others (*Implement*). This effectively permitted the design and construction of new preclinical brain MRI scanners, tailored to real-world deployment in resource-constrained settings.

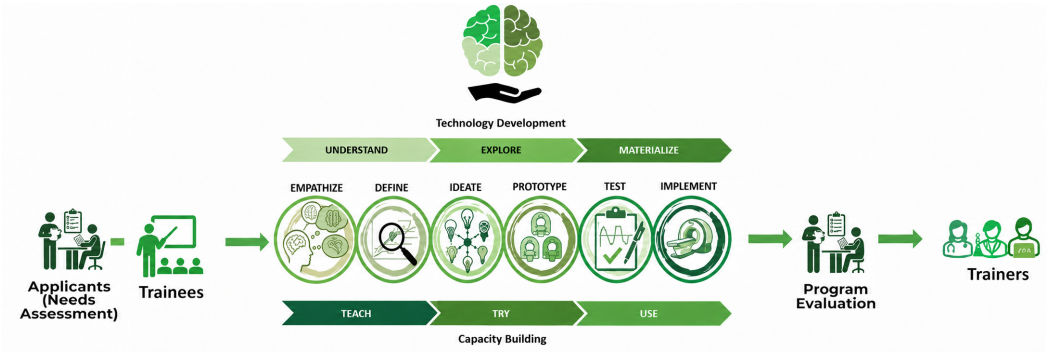


FIGURE 1 The IMAGINE train the trainer approach (RAD-AID'S Teach-Try-Use model)

2.2 | Program Structure

The IMAGINE Summer School follows a 9-week hybrid format. Learners enter the program through a needs assessment-based application process that assesses their background in MR physics and engineering; prior experience in MR image acquisition and analysis; experience with LF-MRI; local imaging resources, including access to an MRI system; prior MRI hardware education or training; and their motivations, interests, and expectations from a free open MRI engineering education. Learners across imaging-related disciplines (physics, engineering, radiology, radiography, computer science, neuroscience and veterinary medicine) and MRI backgrounds (none, novice, intermediate, or advanced) are enrolled in the program based on their motivation, skills, and commitment to actively participate in the 9-week long program including online components. The pilot program was delivered between May and August 2025 to evaluate the replicability and reproducibility of the training model and preclinical LF-MRI systems across geographically distinct settings, with two onsite build labs; one in Cape Town, South Africa and another in Montreal, Canada. Leveraging the

pilot program alumni (trainees to trainers), a second Summer School was conducted between June and September 2026 with the addition of four onsite build labs as described above. Each Summer School adopts CAMERA's blended peer-to-peer learning strategy, structured in the form of small groups, where all modules and exercises are completed in groups to promote interdisciplinary peer learning, instill a collaborative knowledge transfer culture, and enhance professional networking across settings [1]. Learners are enrolled into build site-based teams and assigned to one of the three functional subgroups, based on their MRI background, technical abilities, and interests declared during the application process. Each group is led by a team captain, with inter-team, intra-group, and across program communications maintained via dedicated WhatsApp forums (Figure 2). Teams also have weekly Zoom meetings to review course materials, work on assignments, and receive peer-to-peer support.

The three functional subgroups are structured around onsite build labs as follows:

1. **Hardware sub-group**: Focused on design and physical assembly of scanner magnet, construction of gradient and RF coils, and troubleshooting of transmit and receive chains.
2. **Image Acquisition sub-group**: Focused on implementation of open-source image acquisition, reconstruction and pulse sequence programming methods.
3. **Image Processing sub-group**: Focused on the design of quality assurance MRI phantoms, development and application of quantitative scanner performance testing including denoising and image post-processing.

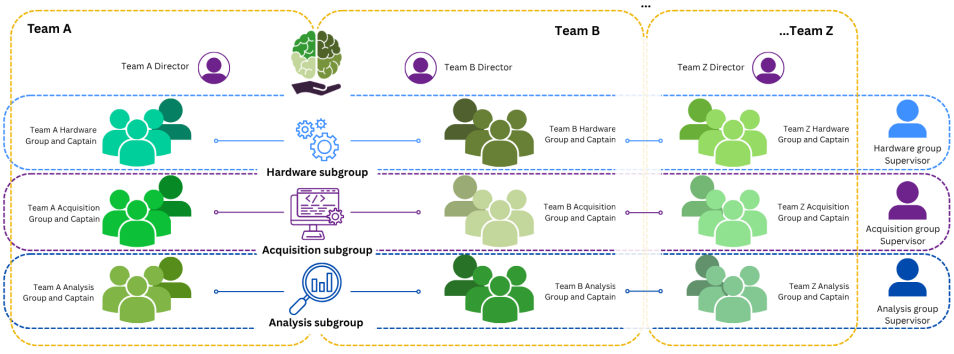


FIGURE 2 The IMAGINE Summer School team composition. Learners from each site form a site-based team (Team A, B, …Z), grouped into functional subgroups with learners working towards assembly of a functional preclinical LF-MRI scanner.

2.3 | Educational Content and Delivery

The curriculum was intentionally developed to reflect the learning capacity of multidisciplinary LMIC-based students and professionals who possess a wide range of prior MRI experience, technical competencies, disciplinary backgrounds, and geographic contexts. A total of 160-hours of lectures, tutorials, and practical hands-on sessions was provided during the Summer Schools via scaffolded learning (TTU; Figure 1), with no more than 2-hour of learning activity per day (except for the build laboratory weeks) and divided into:

2.3.1 | Teach Module: 6-Week self-directed virtual foundation course (80 hours)

These self-paced didactic lectures, curated from open-access reading materials (articles and book chapters) and videos (YouTube, International Society of Magnetic Resonance in Medicine (ISMRM) conference talks, etc.), offered a comprehensive overview of MRI with immediate relevance to the design, local construction, and use of Halbach array LF-MRI systems. Each week progressively introduces concepts in MRI physics and engineering for foundational understanding of low-field MRI including Bloch-equations, electromagnetic fields, magnet design, LF scanner components (RF, gradients, electronics), pulse-sequence programming, image acquisition, and practical challenges in LF-MRI, including field inhomogeneity and low signal-to-noise ratio – key limitations in Halbach array design that need to be considered. This block is designed to teach these concepts over a 60-hour period (2hr/day Monday to Friday), supported by open-source simulators (Bloch [16], Halbach-array optimization [17, 18, 19], gradient-field modeling [20], and pulse-sequence design [21]), case studies (prior open-source LF-MRI builds), problem-centered weekly assignments, 1-hour weekly peer-led reviews, and 2-hour weekend tutorials. The weekly group assignments are given to elicit collaborative work and knowledge sharing, while assessing learner's progress in MRI knowledge acquisition. Each week's assignment is reviewed during the weekend tutorial by content experts in the program's organizing team to ensure that all learners understand the materials. At the end of the foundation module, the goal is to have learners with a shared understanding of LF-MRI, who can articulate its principles, design considerations, construction methodologies, and operational requirements across settings, especially under resource-constrained conditions (*Empathize* & *Define*). Table 1 summarizes the foundation module course topics for each week of the 2025 and 2026 Summer Schools. The pilot program ran as a 5-week foundation module, which was expanded to 6 weeks following the pilot program evaluation insights.

2.3.2 | Try Module: One-week hybrid Build Laboratory (40 hours)

The hybrid build laboratory module provides learners with a full 5-day practical experience to try what they have learnt from the foundation courses in designing, constructing, assembling, and testing low-cost open-source LF-MRI scanner subsystems (*Ideate*). Table 1 summarizes this module's content for the two completed Summer Schools, while section 2.5 below, describes the preclinical 50mT system developed as part of the Summer Schools. Depending on site-specific resources, learners are given a LF-MRI construction group project (Table 2) using components: 1) reused from existing onsite materials, or reproduced from open-source designs, including designs available through Open Source Imaging Initiative (OSI^2; e.g., the passive transmit and receive switch) [22], 2) integrated via open-source hardware and control systems, including Red Pitaya, MaRCoS, and MaRGE [23, 24], 3) commercially sourced, such as low-noise amplifiers and RF power amplifiers, or 4) designed during the Summer School, including the preclinical Halbach magnets, field-mapping robots, RF and gradient coils, and transmit and receive switches. This enables learners to develop low-cost prototype scanners as a team, coached by experienced local MRI personnel who have prior skills in LF MRI Hardware assembly and performance assessment. Build projects are balanced with 1-to-2- hour daily (*how I did it – HID*) seminars from leading experts in LF-MRI, specifically in prior assembly and use of Halbach array MRI systems. At the end of each day, learners are expected to log in their group's build progress, document their build materials and step-by-step assembly process, and report timed deliverables (i.e., achievable milestones, such as field map and values, signal generation, etc.).

TABLE 1 Summary of the 2025 and 2026 IMAGINE Summer School contents.

Week	2025 Summer School	2026 Summer School
Foundation Course (Teach) Module		
1	**Basic Principles of Magnetic Resonance Imaging (MRI):** conceptual overview, MRI system components, Bloch equation, signal equation, 2D imaging, MR excitation	**Basic Principles of Magnetic Resonance Imaging (MRI):** Same as 2025
2	**Introduction to MRI Hardware:** Electromagnetic field, magnetism, low-field magnets, Halbach arrays, Halbach design and optimization	**Introduction to MRI Hardware:** Same as 2025
3	**Gradient and RF coils for low-field MRI:** Gradient coil design, RF coils, RF and gradient amplifiers, shimming, shielding, MRI safety	**Gradient and RF coils for low-field MRI:** Same as 2025
4	**Image Acquisition and Reconstruction:** Pulse sequences, T1/T2 mapping, spatial encoding, Pulseq tutorial	**Transmit and receive chains for low-field MRI:** TR switches, LNA, RFPA, Red Pitaya, RF matching, grounding, cabling, shielding, and FID signal generation
5	**Challenges in low-field MR imaging and Quality Control:** Imaging challenges, scanner benchmarking, field mapping, design thinking, and low-field MRI construction	**Image Acquisition and Reconstruction:** Same as Week 4 of 2025
6	N/A	**Challenges in low-field MR imaging and Quality Control:** Same as Week 5 of 2025
Build Lab (Try) Module		
1	**Construction of 50 mT magnet and its field mapping robot:** Assemble a Halbach array magnet and a field mapping robot and use it to map the field	**Construction of 50 mT systems, its field mapping robot, and signal generation components:** Assemble a Halbach array magnet, field-mapping robot, and signal- and image-generation systems
2	**Design and integrate transmit (T) and receive (R) chains:** RF and gradient coils, T/R switch, electronics, phantoms, and signal-acquisition console	N/A
Practicum (Use) Module		
1	**Transferable Skills I: Scientific Communication.** Conference abstract submission to report and present build-lab work	**Transferable Skills I: Scientific Communication.** Conference abstract submission to report and present build-lab work
2	**Transferable Skills II: Knowledge Transfer.** Open science application and open-access documentation for reproducibility	**Transferable Skills II: Knowledge Transfer.** Open science application and open-access documentation for reproducibility

TABLE 2 Resource-Aware Build Laboratory Projects During the 2025 and 2026 Summer Schools

Year	Site	Prior experience / available infrastructure	Project
2025	Montreal Neurological Institute at McGill University, Canada	New site / introductory hardware task	Full assembly and signal acquisition of a 50 mT, 120 mm inner-bore rat MRI scanner
	Stellenbosch University, Cape Town, South Africa	New site / introductory hardware task	Full assembly and signal acquisition of a 50 mT, 120 mm inner-bore rat MRI scanner
2026	Montreal Neurological Institute at McGill University, Canada	Existing MRI, electronics, or fabrication infrastructure	Full assembly and image acquisition of a 50 mT, 80 mm inner-bore ERNIE scanner
	Stellenbosch University, Cape Town, South Africa	Existing MRI, electronics, or fabrication infrastructure	Participated in step-by-step animation guide tasks
	Medical Artificial Intelligence Lab, Lagos, Nigeria	New site / introductory hardware task	Construction of a 50 mT, 80mm inner-bore ERNIE magnet and 3D field mapping robot
	MRI Uganda, Mbarara University of Science and Technology	Existing MRI, electronics, or fabrication infrastructure	Field mapping of a scanner with a field strength of 281 mT and acquiring images
	Pontifical Catholic University of Chile, Chile	Existing MRI, electronics, or fabrication infrastructure	Full assembly and image acquisition of a 50 mT, 80 mm inner-bore ERNIE scanner
	National Innovation Center, Kirtipur, Kathmandu, Nepal	New site / introductory hardware task	Construction of a 50 mT, 80mm inner-bore ERNIE magnet and 3D field mapping robot

At the end of the week, each group is expected to assemble, disassemble, and reassemble one Halbach MRI magnet, its field map robot, and map the magnet's field. Highly resourced groups, such as sites with an RF lab, power supply, vector network analyzer and other essential equipment for signal generation and testing, are encouraged to use these resources to acquire a standard spin echo signal and two-dimensional (2D) image (Figure 3). For learners who are unable to participate in onsite constructions, immersive full-day online contents are provided, including exercises to design functional MRI systems with inexpensive components to make scanners cheaper and faster to build, as well as easier to operate and maintain in resource-constrained settings. Remote participants are also guided to create animation of the magnet and robot assembly from their group's bill of materials, implement field mapping visualization dashboards [25] to support onsite performance testing, and design pulse sequences suited for their MRI system [26]. They are expected to connect daily with their onsite colleagues to document scanner progress and milestones. These exercises provide hands-on learning for both virtual and onsite participants to stay intrinsically motivated so they can collectively achieve a shared practical understanding of LF-MRI hardware.

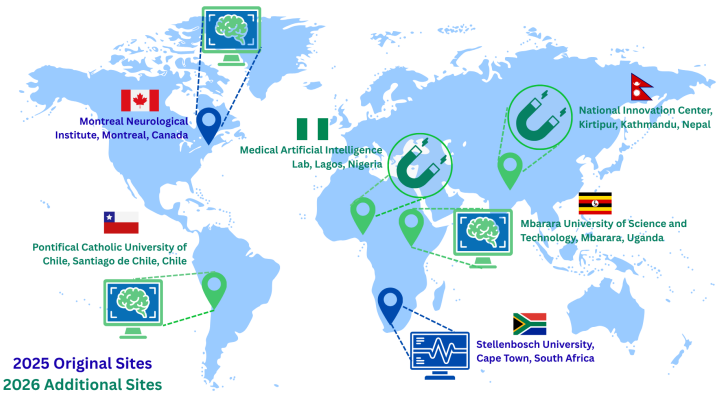


FIGURE 3 Build Laboratory Locations for the 2025 and 2026 programs, illustrating the resource-aware project expectations for each site. Two sites (Nigeria and Nepal) with no access to a local RF laboratory or MRI engineering infrastructure were tasked to assemble, disassemble, and reassemble their magnet and map the fields to investigate replicability. One site (South Africa) with emerging local MRI engineering infrastructure was tasked to generate the spin echo signal, while three sites equipped with standard RF labs and MRI engineering infrastructure generated a spin echo image for their build lab project.

2.3.3 | Use Module: Two-week Virtual Knowledge Translation Practicum

To achieve the key objective of the IMAGINE initiative in rapid MRI engineering capacity building, across all settings, the program was designed to go beyond device performance testing and include structured knowledge transfer for local groups to continue to grow their capacity, self-sufficiently. While the construction of open-source LF-MRI systems, such as those described here, is becoming increasingly implemented, many proposed systems are not replicated due to sparse details in published methodologies. Therefore, we included dedicated training in open science principles, best practices in research methodology documentation, and skills training in written and oral science communication. These efforts are geared towards promoting a culture of open methods sharing for reproducible LF-MRI innovations, especially for settings where resource waste (time, materials, money) from poorly informed builds can be avoided. For the last module of the program (Table 1), learners spent 10 hours per week (2 hours/day, including weekend tutorials) to collaboratively create conference abstracts of their builds in the first week and in the final week of the program, complete their documentation tasks. Documentation includes a bill of materials (BOM) with clear description of the materials and parts number, an illustrative step-by-step system build guide and troubleshooting, animated scanner and robot assembly process, scan testing steps and results including all the series of builds' field maps and links to repositories. Open methods publishing is introduced, as well as compliance requirements [27]. At the end of the program, each group is expected to submit an abstract to an MRI conference such as ISMRM or ESMRMB, present the abstract at a weekend tutorial, and contribute data and documentations towards a comprehensive open-source LF-MRI education platform being developed [28]. The platform includes computer-aided design (CAD), magnet optimization code, assembly instructions, system integrations, and performance measurement steps. In doing so, this facilitates effective collaboration and open innovation across diverse settings. Across all modules, the course contents, including the foundation course materials, mid-week team meetings, live weekend tutorials and seminars, are delivered through an adapted conference management platform (Fourwaves; [29, 30]) with integrated Zoom connection and in-app live communication (Figure 4). This enables onsite and virtual blending of learning activities seamlessly.

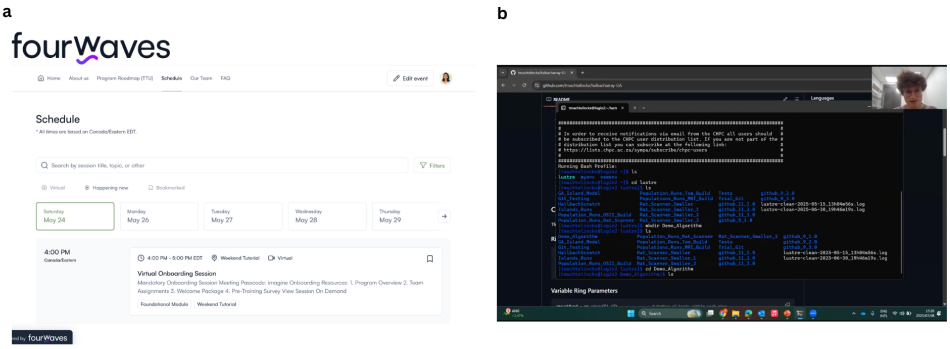


FIGURE 4 The IMAGINE Program is delivered through an adapted conference management platform (Fourwaves) for seamless delivery of the hybrid program (a), including training materials, interactive assignments, and virtual live lectures/seminars via Zoom integration (b).

To accommodate the wide range of time zones where our learners reside, live events are scheduled between 2-4pm West Africa Time, recorded, uploaded to YouTube, and reshared on the program platform for on-demand viewing.

2.4 | Learner's Assessment and Program Evaluation

To continuously assess the learners' progress and progressively identify learning gaps, a series of assessments was conducted regularly, consisting of weekly assignments, capstone projects, and peer-learning review presentations. Attendance in seminars, mid-week meetings, and weekend tutorials was also closely monitored by the program's team supervisors to gauge active engagement, recognize outstanding participants and provide feedback to those who require coaching. To incentivize active participation at the individual level, a program recognition is provided in the form of a certificate, special mentions at weekend tutorials, and congratulatory messages are shared on social media channels.

For the program evaluation, the quality of its curriculum depth and delivery were assessed using pre-and post-training Likert-type surveys, administered at the start and end of the Summer School, respectively. The same set of questions were used to assess their self-reported improvement in understanding of MRI concepts, for both years. This includes questions on self-reported understanding of LF-MRI concepts. The program's success is further quantified by the enrollment numbers, demographic and geographical diversity of the learners, program evaluation results and competency gains of the learners.

2.5 | Scanner descriptions

The design choices for onsite constructions of an MRI system during IMAGINE Summer Schools, hinged on solutions that use open-source lightweight materials, are safe and inexpensive to construct, prototype, and deploy in constrained settings, particularly where MRI engineering infrastructure and skill capacity are limited. Halbach arrays are well suited to these design constraints. It offers portable LF magnet configurations that provide homogeneous magnetic fields in a compact and lightweight design [31]. Their magnetic field is concentrated within the imaging region while minimizing external fringe fields, reducing safety concerns and eliminating the need for costly shielding infrastructure [32]. Combined with low power requirements and ability to scale magnet configurations to preclinical imaging volumes, Halbach-based systems are ideal for designing very low-field MRI scanners that can serve the dual-use for preclinical brain imaging and MRI hardware education.

Although the OSI^2 ONE human brain MRI scanner is an established open-source system and has been assembled by other groups during training events [12], its larger bore size does not lend to prototyping and is more expensive to construct for educational purposes. As such, we developed low-cost preclinical Halbach array-based MRI systems with a target magnet field strength of 50 mT, bore dimensions suited for rat or mice brain imaging, and components for RF and gradients that are prefabricated or sourced locally (Table 3). The rat brain scanner was first developed during the pilot program and trainees immediately translated the designs to develop the smaller mice scanner, more suited for educational purposes (ERNIE: the CAMERA-IMAGINE MRI Education scanner).

Magnet Design: A new genetic algorithm (GA) was developed by the Stellenbosch group to optimize the number of magnets, number of rings, and ring diameters to determine the best magnet configurations for the desired target field strength and scanner dimensions [33]. Briefly, the GA executed using an island model [34], optimizing a multi-ring Halbach array design using: 1) a predefined dataset of individual ring designs, (2) a magnetic field simulator, and (3) fitness evaluation. The initialization process starts with user-defined parameters (outer diameter, inner bore diameter, number of bands, magnet size and spacing, band gap, array length, and number of rings), which are used to generate a dataset of individual rings [18]. Halbach arrays are then created from ring combinations using rings from the predefined dataset. Each of these arrays forms an individual in the GA population, which is then evaluated and evolved to minimize field inhomogeneity and target field error. The simulated magnetic field strength on the spherical volume (F) is approximated by the superposition of each magnet, individual contributions on each ring using the single dipole model. The fitness function is implemented as

$$f(x) = 0.8EH(x) + 0.2ET(x), \text{ where } EH(x) = \frac{(\max(F) - \min(F))}{F}, \quad ET(x) = |F - T|$$

$EH(x)$ and $ET(x)$ are the homogeneity and mean magnetic field strength error functions, respectively. Note that F is the mean value of spherical volume, T is the target mean field strength, and x is the configuration vector that describes which rings from the dataset are being used. The optimal combination of rings is then used during the build labs to assemble the Halbach array, with each 3D-ring printed to house the neodymium magnets. The GA model and code can be publicly accessed through [35].

Magnet assembly: During the build labs, the defined optimal ring configurations were designed in a CAD software (Autodesk Inventor 2025), and STL files were generated for fabrication on a 3D printer (e.g., Bambu Lab P1S in Canada, South Africa, and Nepal or Prusa XL+ Dual-Head in Chile). Several N48 neodymium magnets (12 mm × 12 mm × 12 mm) are carefully inspected, numbered, polarity-marked, and then inserted into the ring magnet slots (Figure 5). The assembly process includes verification of magnet orientation using a compass placed at the center of each ring, securing the magnets using protective lids with brass heat inserts and screws, and using brass rods to stack the full ring structure, according to their defined ring configuration. 3D printed ring spacers, designed to match the required ring (12 mm) separation, are placed between the rings to ensure uniform spacing with a final step of fastening brass nuts/nylon nuts at both ends of the brass rods. The STL files and step-by-step illustration of the magnet assembly are available on the IMAGINE scanner repository [36].

Magnet field mapping: Standard approaches for field mapping use field cameras and robotic devices, with costs reaching tens of thousands of dollars, which is inconceivable when considering low cost open-source LF designs [37]. The Summer School introduced two open-source low-cost approaches for mapping the magnet and gradient fields, along its three-dimensions: a manual grid-based and a three-axis robotic mapper. Both approaches were developed to close the gap in field mapping tools that are largely cost prohibitive for LMICs groups, provide simpler mapping tools that do not require advanced assembly or operational skills and can be used readily during prototyping, opti-

mization, and validation stages of magnet construction (e.g., de-risking Halbach-array development, making shimming adjustments, implementing quality assurance routines, or for maintenance and fault detection) [38].

The manual grid-based mapper is a 3D-printed grid with a handle that enables controlled placement of the magnetometer probe in the xy-plane of the field. The field is then measured manually as the grid is moved down the bore of the scanner in the z-axis to collect magnetometer readings on the xy-planes. The travel-path planning is predetermined by set distances in the z-axis and the grid distribution on the mapper. Readings are collected at timed intervals, after stabilization of probe readouts in a grid and with a calibrated magnetometer [38]. The materials and instructions for fabrication and using the manual mapper are available on the repository [28].

The three-axis robotic system also follows a cartesian-like approach for mapping the field along its three axes around a given diameter-spherical-volume (DSV). It uses three stepper motors with TB6600 driver (one/axis) to control movement and positioning of a magnetometer probe. The magnetometer probe is secured on a 3D printed holder to move it in predefined (e.g., 4 mm) increments. For the robotic system, a software was designed to allow each of the three components to be updated and improved independently. Motion control was managed by an Arduino UNO R4 Minima, connected via USB to a Python (version 3.13) environment. The pipeline executes commands to guide the robot along the path, initiates data acquisition calls, performs data queries, and saves the data[38]. Materials, assembly instructions, and software codes are published openly, here [39]. The acquisition software was designed in the pilot program to automatically capture readouts from an Alpha Labs GM2 Gaussmeter (DC Milligauss Meter Model MGM), and adapted to other magnetometers (e.g., Hall-effect sensor or Metrolab 3-axis gaussmeter). The estimated cost for the robot and grid-based mappers are $400 and $50, respectively, excluding the Gaussmeter, a basic 3D printer, and computers.

A dashboard for visualization of the field map results was created for rapid visual inspection and quantification of field map values, including magnetic field strength values (mT/μT), peak-to-peak (P-P) homogeneity, and root mean square (RMS) inhomogeneity. The dashboard accepts field map excel files containing the X,Y, Z measurement positions (mm) and the corresponding B0 field values (T) and then displays the plots of 2D and 3D map renderings, computes field deviation values (compared to the average magnetic field), and can compare multiple field maps from repeat scanning (e.g. assemble and reassemble) or across sites. The current implementation of the dashboard is publicly accessible through the dashboard repository [25].

Scanner RF and Gradient Subsystems: For resourced sites in Chile and Canada, RF and gradient subsystems were designed and assembled to explore signal generation. A simple Solenoid RF coil was constructed on a 3D printed coil former, wound with copper wire, and loaded with an olive oil phantom (Figure 5). The RF electronics subsystem included a Red Pitaya (IZD0021 SDRlab 122-16) for signal generation, RF power amplifier (RFPA), and low-noise amplifier (LNA) to increase the amplitude of the signal while minimizing noise, a passive switch built during the Summer School, and the tuning and matching circuit (Figure 5). The scanner (Canada only), RF, and electronics were shielded with aluminum sheets, aluminum boxes, and copper sheets, respectively. A spin echo signal (TR Chile Ernie / Canada Ernie / Canada IMAGINE rat = 300/1500/1000 ms) was acquired without shimming at a set Larmor frequency and number of averages (Chile ERNIE/Canada ERNIE/ Canada IMAGINE rat =30/16/16) using the open-source MaRGE acquisition console [24] (Canada scanners) or a python-script-controlled Magritek Kea spectrometer (Chile ERNIE).

For the gradient subsystem, a set of X, Y, and Z gradient coils was designed and built to fit within the bore of the preclinical scanners based on a discrete wire approach [40, 41]. The gradient winding patterns were 3D printed on coil formers and wound with copper wire. An in-house assembled open-source gradient power amplifier (FHDO GPA) [42, 43] was used to drive each gradient coil. The GPA has four channels with a maximum current output of 10 A each and controlled by the Red Pitaya through a serial peripheral interface (SPI) communication. A switching DC power supply (TekPower TP1560E) set to 15 volts powered the GPA. Each gradient coil was connected to an

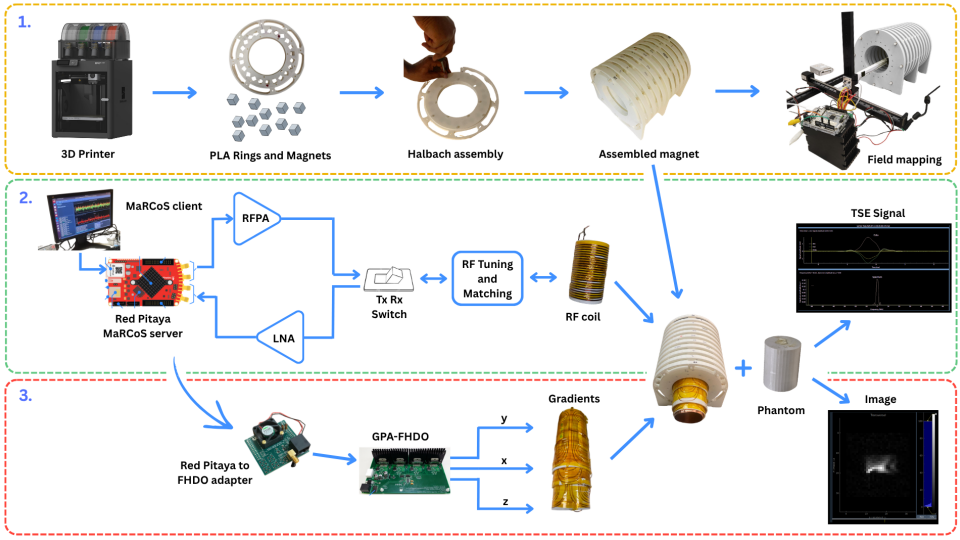


FIGURE 5 Steps to build an IMAGINE Scanner: 1) Print and assembly of the Halbach magnet, followed by field mapping with the three-axis robot. 2) Set up of RF chain to acquire a signal. 3) Integration of gradient circuit to acquire an image using a phantom. The Canada rat scanner components, signal and images are depicted here, but similar steps and components were used across sites to assemble the rat and mice/educational (ERNIE) scanner.

in-house-built gradient filter, constructed using three high-current power inductors (CODACA CPER3231-101MC) and three high-power capacitors (490-GCJ55DR7LV474KW01KCT-ND). The key components of the scanners are illustrated in Figure 5 and summarized in Table 3, along with dimensions for the two scanners implemented at the Canada site. Detailed component specifications including the power supplies used for gradient amplifiers, LNA and RFPA, assembly instructions, and supporting documentation are available in the IMAGINE repository [28].

2.6 | Reproducibility

A clear difference of our LF-MRI education approach, compared to previous build workshops, is the ability to decentralize training, by providing learners the opportunity to learn together in their local settings, instead of consolidating students in one physical space. This provides more opportunities for learners who cannot afford to travel to the usually high-resourced settings to learn, or for whom other restrictions (e.g., visa, work constraints) may bar their onsite participation. However, for a hybrid multi-site approach to be successful, training materials including scanner constructions must be reliably implemented similarly across sites. The success equally depends on availability of local experienced LF-MRI professionals who can conduct summer schools in their region, as well as access to reusable scanner components for low-cost scalability. Therefore, we assessed cross-site reproducibility of scanner builds across the two years of the Summer School to explore the feasibility of extending future summer schools, broadly across diverse resource and capacity settings. We compared key technical milestones including magnet field strength and homogeneity, evaluated the agreement between measured and expected field maps, measured the repeatability (map & re-map) after reassembly, and noted independent successful signal and image acquisitions using shared open methods, including the extent of troubleshooting support required.

TABLE 3 Core components and key dimensions for the IMAGINE Summer School scanners

Parameter/Component	2025 Summer School	2026 Summer School
Canada Scanner Reported	IMAGINE rat scanner	ERNIE scanner
Magnet System		
Inner bore diameter (mm)	120	80
Outer bore diameter (mm)	240	190
Length (mm)	252	168
Number of magnet rings	11	7
Magnetic field strength (m̄T)	50	50
Magnet type (NdFeB N48)	220 x (12 x 12 x 12) mm^3	99 x (12 x 12 x 12) mm^3
Field mapping (Robotic system only)		
3D Field mapping system	Modular low-cost 3D field mapping Robot [38]	Modular low-cost 3D field mapping Robot [38]
RF subsystem		
RF Coil	Solenoid RF coil	Solenoid RF coil
Coil Height/Outer Radius/Inner Radius (mm)	90/30.5/28	90/22/20
Copper AWG (American Wire Gauge) / Turns	14/24	18/18
TR switch	Passive TR switch [44]	Passive TR switch [44]
RF power amplifier	Mini-circuits (ZX60-100VH+)	Mini-circuits (ZX60-100VH+)
Low noise amplifier (LNA)	Wenteq (ABL0050-00-4510)	Wenteq (ABL0050-00-4510)
Gradient subsystem (X, Y, and Z gradient)		
Gradient coil design approach	Discrete-wire gradient coils [40, 41, 45]	Discrete-wire gradient coils [40, 41, 45]
Copper AWG (American Wire Gauge) / Turns per quadrant (X, Y, Z)	16 / (6, 6,10)	18 / (5,5,10)
Gradient amplifier	In-house assembled Open source FHDO gradient amplifier [42]	In-house assembled Open source FHDO gradient amplifier [42]
Acquisition system		
MRI Console/ hardware	SDRlab 122-16 Standard Kit (IZD0021)	SDRlab 122-16 Standard Kit (IZD0021)
Imaging phantom	Cylindrical phantom	Two compartment cylindrical phantom
MRI Console/software	MaRCoS/MaRGE [24]	MaRCoS/MaRGE [24]
Approximate system cost (CAD)		
*Scanner cost (CAD)	$10,226	$9,338
*Scanner and Laboratory equipment (CAD)	$16,684	$15,796

* Costs associated with procuring the minimum equipment required for signal generation and image acquisition. Detailed cost information is available in the IMAGINE platform repository [28].

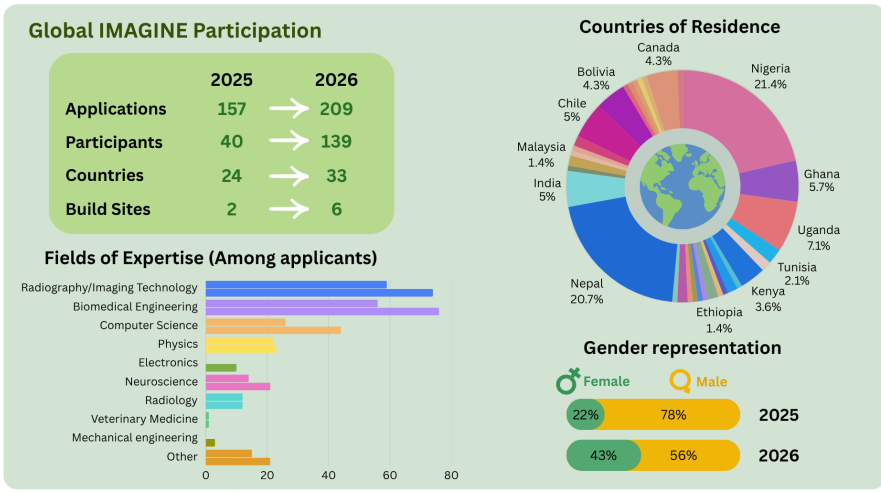


FIGURE 6 Program participation statistics, including gender representation, participant demographics, and fields of expertise, highlighting IMAGINE's multidisciplinary and inclusive cohort composition.

3 | RESULTS

3.1 | Learners Demographics

The 2025 program received 157 applications from 24 countries, while the 2026 program application increased to 209 from 20 countries. A total of 40 learners from 12 countries were enrolled in the pilot and 139 in 2026 from 33 countries, with 49% residing in Africa (Figure 6). They represented a diverse range of professional and academic backgrounds, with the majority from radiography, biomedical engineering, computer science, and physics (Figure 6). The pre-program surveys indicated heterogeneous levels of prior MRI exposure; while some participants reported experience with MRI acquisition or image processing, most had limited prior exposure to MRI hardware design, construction, or system integration (Figure 7). This diversity of backgrounds was reflected in the interdisciplinary team composition at each training site.

3.2 | Educational Outcomes

A total of 180 hours and 152 hours of instructions were provided across the three modules, in the pilot and subsequent Summer Schools, respectively. Of these, 139 and 113 hours, respectively, were devoted to highly engaging learning media (videos), simulations, or hands-on exercises. This includes an 80-hour two-week build lab in 2025, reduced by half in 2026 to include the extra foundation course week (Table 1). These curriculum adaptations did not impact the overall program quality (Figure 7) or the perceived value learners received (Figure 8). Specifically, the pre- and post-program surveys completed by 18 and 85 respondents from the 2025 and 2026 programs, indicated a significant improvement in self-reported understanding of various MRI concepts covered during the Summer School. In both cohorts, post-program ratings were higher across the assessed domains, indicating improved perceived understanding. For example, the proportion of participants reporting familiarity with low-field MRI systems on conclusion of their training, increased by 26.6 percentage points in 2025 and 47.4 percentage points in 2026, compared to when they started the training. All respondents agreed that the program improved their knowledge of designing and building a

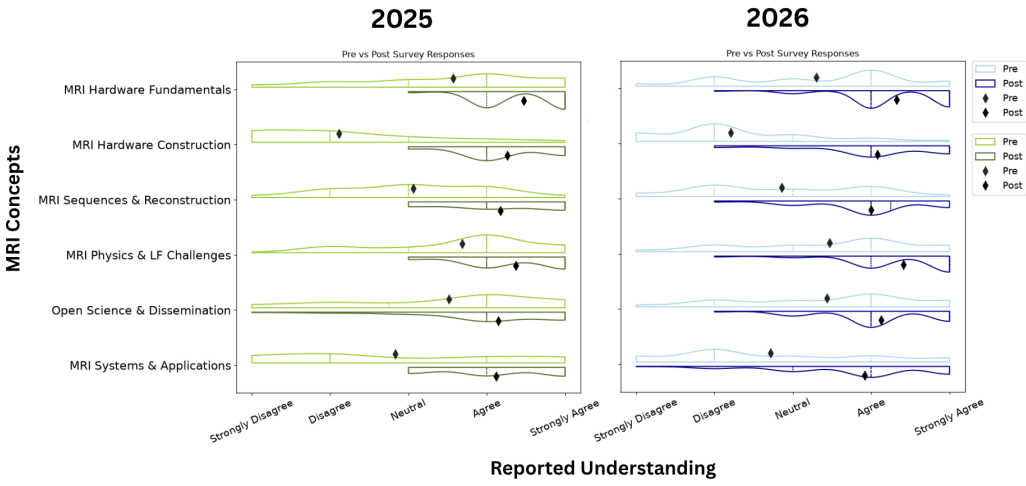


FIGURE 7 Pre- and post-program self-reported understanding of MRI concepts. Left: 2025 cohort. Right: 2026 cohort. Light- and dark-coloured violin plots represent pre- and post-program responses, respectively. Diamonds indicate mean reported state of understanding.

low-field MRI system, with 81.3% and 58.0% strongly agreeing in 2025 and 2026, respectively. Overall satisfaction remained high in both years, as 100% of survey respondents indicated that they would recommend the IMAGINE Summer School to a colleague.

Qualitative feedback from learners in response to open-ended questions was very positive in both years (Figure 8). The most frequently highlighted aspect of the program was the hands-on experience of constructing a low-field MRI system as well as the quality of teaching and learning materials, mentioned by nearly half of respondents (Figure 8). Respondents also emphasized the value of interdisciplinary collaboration and the opportunity to interact with experts during seminar sessions. Suggested improvements primarily focused on increasing engagement opportunities for remote participants during the build labs, expanding hands-on workshop time, and providing additional support for participants with limited experience (Figure 8).

3.3 | Technical and System-Level Outcomes

The onsite scanner constructions were completed during the build lab of each Summer School at one of the following institutions:

a) McConnell Brain Imaging Center, Montreal Neurological Institute, McGill University, Montreal, Canada (2025/26)
b) Biomedical Research Institute, Stellenbosch University, Stellenbosch, South Africa (2025)
c) MRI Uganda, Mbarara University, Mbarara, Uganda (2026)
d) National Innovation Center (NIC), Kathmandu, Nepal (2026)
e) Institute for Biological and Medical Engineering and Biomedical Imaging Center, Pontificia Universidad Católica de Chile (2026)
f) The Medical Artificial Intelligence Laboratory, Lagos, Nigeria (2026)

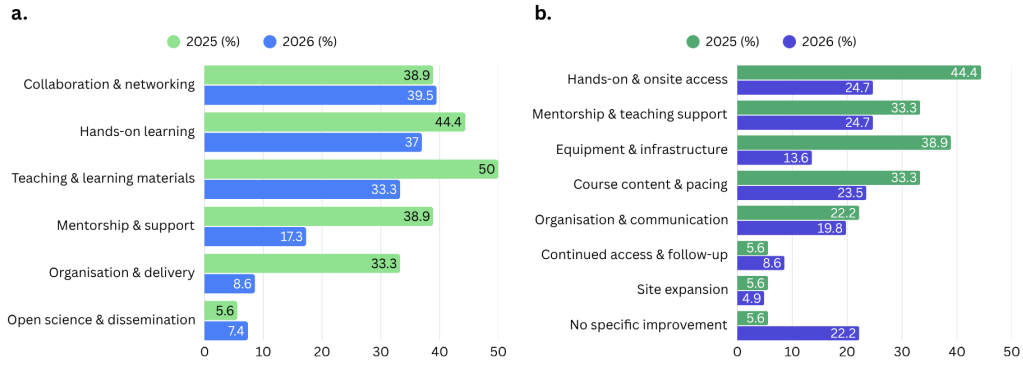


FIGURE 8 Most valued components of the IMAGINE Summer School in 2025 and 2026, based on open-text learner feedback (a) and learner suggestions for improving the program (b). Open-text feedback was thematically coded. Percentages are calculated relative to all responses within each cohort (2025: n = 18; 2026: n = 81).

The constructions resulted in 6 preclinical magnets assembled across 6 sites (Table 4): 2 rat brain scanners (one with integrated RF and gradient components), and 4 mice/education scanners – ERNIE (two with integrated RF and gradient subsystems). The general specifications of the two types of preclinical systems and their key components are summarized in Table 3. Each of the 6 sites successfully constructed their chosen preclinical system during the build lab weeks, following a structured daily schedule (Figure 9). All builds were constructed by learners, guided by one or two experienced local experts, including past program participants who provided a general overview of build steps. Eleven trainees (27.5%) from the 2025 program joined in 2026 as group supervisors to train new trainees. All but two of these trainees participated in the 2025 build lab virtually, demonstrating the feasibility of our train-the-trainer approach. As trainers, they reviewed assignment questions, conducted weekend tutorials, and provided onsite local guidance for the build labs.

The two field mapping solutions, designed using non-expensive off-the-shelf components and in-house developed software, allowed obtaining of 2D and 3D field maps with adjustable spatial resolution. The grid-based manual mapper was used to map the rat brain magnet at 6 cm DSV and 315 points, to yield a peak-to-peak homogeneity of 15,563 ppm, a mean field strength of 49.15 mT, and Larmor frequency of 2.09 MHz. Field maps of assembled (6) and reassembled (3 out of 6) scanners mapped using assembled three-axis robot are reported in Table 4 and illustrated in Figure 9. Across sites, the mean field strength was between 46.85 mT and 51.02 mT and homogeneity varied, ranging from 5,447 ppm to 40,615 ppm for the ERNIE magnet, and 7,535 ppm to 13,612 ppm for the rat brain magnet, after the first build (Table 4). Improvements in magnet field strength and peak-to-peak homogeneity were observed in all 4 rebuilds. The Nigeria magnet showed the worst performance, most likely due to it being the most reused scanner, including onsite workshop assembly at the 2025 ESMRMB Congress and the 2026 ISMRM Conference. Its individual magnets may have varying signs of wear of tear from repeated assembling and disassembling processes. In general,

using a shared methodology document for magnet and robot assembly and field mapping measurement, enabled rapid implementation and reproduction of visualized field maps (see bottom row of Figure 9). For sites with resources for image acquisition (Canada and Chile), phantom scan of spin echo 2D images were acquired (Figure 10). Notably, the Uganda build lab was completed using a pre-existing 280 mT Halbach array magnet, first assembled in 2022. Learners mapped its field over a 6 cm DSV with a 0.5 mm grid, yielding 925 measured points. The mean field strength was 280.8 mT and peak-to-peak homogeneity was 535,770 ppm. For the rest of the sites, the mean field strength, homogeneity and Larmor frequency, of assembled and reassembled scanners, where reported are summarized in Table 4.

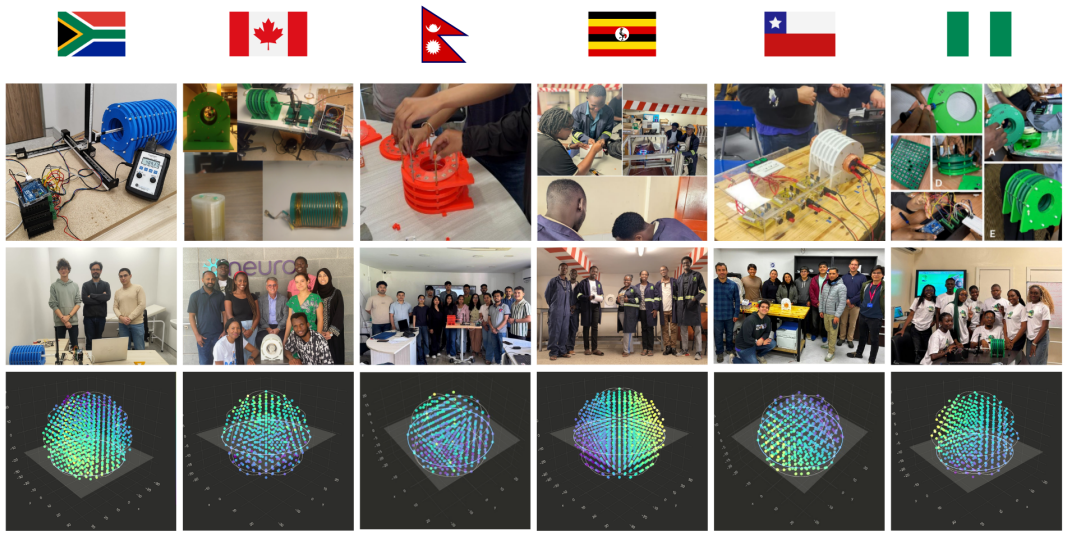


FIGURE 9 Outcomes of two IMAGINE Summer Schools across the 6 participating sites, from left to right: Stellenbosch, South Africa; Montreal, Canada; Kathmandu, Nepal; Mbarara, Uganda; Santiago, Chile; and Lagos, Nigeria. Country flags, scanner builds, team photos, and a representative field map acquired on the scanners are shown from top to bottom.

3.4 | Dissemination and Open-Science Outcomes

Hardware designs, bill of materials, software codes, phantoms, and educational resources developed through the two years of the IMAGINE Summer School are disseminated through the program's open repositories and 13 conference abstract presentations (2 African Chapter of the ISMRM Annual Meeting – 2025; 5 ISMRM Annual Meeting – 2026; and 6 ESMRMB Congress – 2026). These resources are being consolidated into a unified online platform for accessible web-based documentation [46]. The aim is to provide the information required to reproduce the IMAGINE scanner in a practical, readily usable format. This documentation is developed to meet the documentation specifications for open-source hardware reviewed by the Conformity Assessment Board (CAB) of OSI [2] [27].

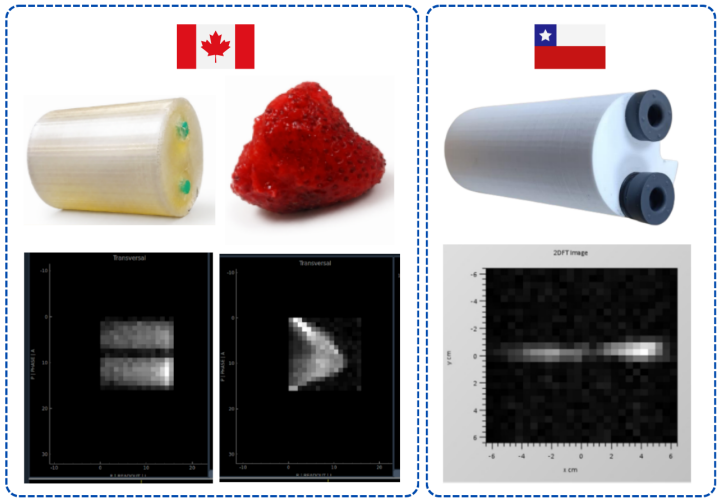


FIGURE 10 Phantoms and Spin Echo MR images acquired of those phantoms on the ERNIE scanners at the Canada (left) and Chile (right) sites.

TABLE 4 Overview of Scanner Builds and Field map results from the 2025 and 2026 Program

Parameter	Canada 2025	South Africa 2025	Chile	Canada 2026	Nepal	Nigeria
Magnet	IMAGINE rat scanner	IMAGINE rat scanner	ERNIE	ERNIE	ERNIE	ERNIE
Before reassembly						
Diameter of Spherical Volume (cm)	6	6	4	4	4	4
Homogeneity (p-p) (ppm)	13,612	7,535	6,878	5,447	15,655	40,615
Mean field strength (mT)	49.6	49.5	52.48	50.4	51.0	46.8
Larmor frequency (MHz)	2.11	2.11	2.23	2.15	2.17	1.99
Number of points	913	913	525	525	515	520
After reassembly						
Homogeneity (p-p) after reassembly	7,581.57	–	–	–	13,294	29,525
Mean field strength (mT) after reassembly	49.76	–	–	–	50.11	48.0
Number of points after reassembly	916	–	–	–	525	525
Larmor frequency (MHz)	2.11	–	–	–	2.13	2.05
Gauss meter	AlphaLab 1	AlphaLab 1	AlphaLab 2	Metrolab	49E726BG	AlphaLab 1

* AlphaLab 1 corresponds to AlphaLab GM2-1 axis DC/AC gauss meter, AlphaLab 2 corresponds to AlphaLab Vector/Magnitude Gauss Meter (Model VGM), Metrolab corresponds to Metrolab 3-axis Gauss meter (Model THM1176), 49E726BG corresponds to 49E726BG linear Hall-effect sensor.

4 | DISCUSSION

Opportunities for practical hands-on MRI hardware training to demystify MRI engineering remain limited. This work introduced a curriculum that provides competency-based education and skills training in fundamental concepts of low-field MRI hardware, through experiential learning. Experience from training 179 international multi-disciplinary cohorts across resource and geographical settings, demonstrates the feasibility of using a peer-collaborative learning approach to rapidly advance local MRI hardware skills. The immediate contribution from a quarter of the trained pilot cohort in the subsequent program edition, despite many participating remotely, validates the adapted train-the-trainer model. Likewise, the strong positive response of trainees to the program evaluation, and their perceived enhanced MRI knowledge also demonstrates that hybrid teaching format can support site-specific scanner building-activities, decentralizing access to MRI engineering training.

Although phantom images were only acquired at two sites and three scanners, the ability of new learners to assemble these systems, design, and integrate their RF/gradient subsystems in less than a week is noteworthy. Their efforts extended beyond the primary educational objective of the two Summer Schools, which is to develop practical MRI hardware literacy and the local capacity to build, test, troubleshoot and iteratively improve low-field MRI systems. Achieving diagnostic-quality images is currently premature and will require further systems development, as alluded below. Instead, the two Summer Schools created troubleshooting scenarios to boost literacy, particularly for construction in resource-constrained settings. For example, one of the sites improvised a hall-effect sensor (Table 4) for three-dimensional field mapping – the sole available magnetometer and successfully automated the voltage-to-gauss conversion. This allowed the site to perform similar field mapping procedures using the IMAGINE field mapping robot and participate in cross-site comparative analysis.

The primary strength of our training approach was the shift from theoretical MR concepts to practical engineering. While MRI physics can be taught through theory and software simulations [47], the physical construction of a Halbach array scanner forced trainees to confront the constraints of low-field MRI, including high magnetic field inhomogeneity, high noise, hardware integration and troubleshooting. The successful design and assembly of the hardware by all teams demonstrates a high level of competency was achieved. This required trainees to assemble magnets, construct RF coils, wind gradient coils, integrate transmit and receive chains, and engage with acquisition software. These activities provide an applied understanding of the relationships between scanner components and imaging performance. Additionally, the simultaneous implementation of build laboratories motivated teams, enabling them to compare progress, identify shared challenges, and troubleshoot bottlenecks collaboratively. In this way, signal acquisition was achieved at both sites in 2025, while signal and image acquisition were achieved at two of the three sites aiming to construct a full scanner, while magnet construction and field mapping were completed at five of the six participating sites. These outcomes demonstrate the feasibility of distributed low-field MRI hardware construction while also highlighting the practical variability associated with local infrastructure, prior experience, and local component availability – the main reason one site missed their preclinical scanner build.

While interests in preclinical imaging are still in ultra-high field (7T and higher) systems, a few low-field preclinical options [48] are being introduced, including a recent open-source 66 mT multi-nuclear system [49]. Centering the IMAGINE Summer School on scanner designs for new preclinical Halbach array configurations, offered a unique opportunity to present two high-fidelity prototype systems for rat and mice brain imaging, in parallel with skills training. These scanners will progressively be developed over iterations of the IMAGINE Summer School, to continue to offer trainees engaging learning environments, and promote collaborative co-development across settings, for future real-world deployability. This includes expansion of curriculum to include more topics in preclinical image acquisition at low-field, pulse programming for rat and brain imaging at low-field, and artificial intelligence (AI) guided image recon-

struction, processing (e.g., denoising), and analysis (e.g., image resolution enhancement). Opportunely, the program has included trainees with radiography, physics, computer science, neuroscience, and veterinary medicine background. Their continued involvement in future programs, will make these scanners viable platforms for holistic MRI education, beyond hardware, towards other MRI domains. For example, the relatively low-cost materials and labor to construct these open-source systems, makes it possible to integrate in formal biomedical engineering training [50], undergraduate and graduate MRI physics courses, or even in radiography training [51], as experiential learning labs.

4.1 | Limitations and future work

The outcome of the first two implementations of the IMAGINE Summer School are promising, but areas of improvement are noted. First, each learner's competency was not individually assessed and increase in MRI literacy cannot be categorically inferred, since assignments were largely performed on a group level. In addition, the self-reported increased understanding of MRI concepts should equally be interpreted as perceived educational outcomes rather than objective measures of technical competence. Second, remote participation in practical hands-on educational activities have its inherent drawbacks, including demotivation of interested learners, time zone challenges, and network connectivity issues in some settings. Future programs will expand simulation tools, introduce more animated content to engage remote learners. Furthermore, increased availability of skilled local mentors and access to local training spaces and funding, will increase onsite training opportunities for future build laboratories. Third, the varying capacity and resources across sites, while appropriate pedagogically, limited head-to-head comparisons to fully investigate reproducibility. Efforts are underway to conduct standardized cross-site data acquisition to examine lingering reproducibility questions. Finally, longitudinal follow-up with program participants is needed to determine whether the knowledge and skills acquired through the Summer School are retained, translated into local research or clinical activity, and ultimately contribute to sustainable MRI capacity in low- and middle-income settings.

5 | CONCLUSION

The IMAGINE Summer School demonstrates the feasibility of a structured, hardware-centred educational model for MRI training. By combining theoretical preparation with hands-on system construction, the program highlights the value of experiential learning for developing sustainable imaging capacity and technical expertise. The hybrid curriculum and open-access documentation provide a transferable framework for training in low-field MRI and other open-source medical hardware technologies. Future work will focus on evaluating the longitudinal impact of the program on participants and expanding the initiative to additional training sites. Building on the experience of the first two programs, increased trainer support, and expanded institutional partnerships, the IMAGINE Summer School has the potential to extend its reach and contribute to broader access to high-quality MRI education in regions where it is most needed.

Acknowledgements

This work was funded through the generous support of The Neuro (Montreal Neurological Institute), the McConnell Brain Imaging Center at the Neuro, Avis Wood Cone Award and the Tanenbaum Open Science Institute (TOSI) Neuro Open Science Grant. Maureen Nayebare appreciates McGill University Graduate and Postgraduate Studies for the Graduate Mobility Award that supported local scanner development in Africa and the Department of Biological and Biomedical Engineering for the BBME Excellence Award. G. Sahonero Alvarez acknowledges that his work was supported by ANID-Sub dirección de Capital Humano/Doctorado Nacional/2022-21221523 scholarship, the Millen-

nium Science Initiative Program through the Millennium Institute for Intelligent Healthcare Engineering (iHEALTH; ICN2021_004), and the PhD Program in Biological and Medical Engineering from the Pontificia Universidad Católica de Chile. The authors thank the IMAGINE 2025 and 2026 Faculty and trainees, and Organizers of the 2025 ESMRMB Congress for supporting this work. The authors are grateful to the Nepalmed Foundation for its financial support of the Nepal site. The authors thank Core Technology Platforms at NYU Abu Dhabi for providing support for student onsite participation and materials for robot assembly. Finally, the authors thank Antoine Daridon from Metrolab Technology SA and Brian Richter from GMW Associates, California, USA, for their generous contribution of a Three-axis Hall Magnetometer (THM1176) for field mapping.

Conflict of Interest

The authors declare no conflict of interest.

Data Availability Statement

All the necessary documentation to replicate the scanner is provided on the IMAGINE github repository [28].

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