SYMET Thematic Paper II

Increasing education and training capacity for the WMO Members

1. Introduction

This paper is designed as a thought piece that provides an overview of the current research and activities associated with training and education focussing on education and training for WMO Members. This paper also provides the results of the World Meteorological Organization workforce assessment highlighting the demand for training and demographics of members and of the next generations of learners we must tailor training for.

We review: 1) the WMO Workforce Assessment, 2) challenges and emerging issues for learning and development, including assessment of learning needs, alternative learning sources, cultural changes in learning, online and self-directed learning, gamification and simulations, and competency based learning, before 3) drawing conclusions and making 4) recommendations for directions in education and training for WMO Members. The goal of this paper is to stimulate a discussion focused on applying the emerging ideas outlined in this paper and collaborations between organizations to increase the global meteorology training and education capacity available to support the WMO global workforce.

2. Situational analysis: WMO Member Workforce Assessment

2.1 Recent survey conclusions

Based on a 2017 survey of WMO Members administered by the WMO ETR Office:

- The total number of NMHS workers across the globe is at least 170,409 people, based on 80% of Members responding. (when counted by age brackets)
- Almost one-third (31%) of global NMHS staff are more than 50 years old. Only 17% of global NMHS staff are less than 30 years old.
- 45% of global NMHS staff are women and 55% are men.
  - There is considerable variation in gender balance by Region and by individual Member states.
  - It is not possible to determine from this survey in which job categories the men and women in the NMHSs are working. The men and women may be represented in different balances among the various job categories.

Job categories A: Numbers of staff

Table 1. Global number of NMHS staff by job category

Job Category	Number of workers	Percent among the 9 job categories	Percent of total NMHS workforce
Managers	14,016	10%	8%
Meteorologists	30,088	21%	18%
Met Techs	41,130	29%	24%
Hydrologists	2,492	2%	2%

Hydro Techs	2,955	2%	2%
Climatologists	10,684	8%	6%
Researchers	15,286	11%	9%
Support Staff	13,430	10%	8%
Other	11,163	8%	7%
Uncategorized	*29,165*	*N/A*	*17%*
Total	**170,409**	**100%**	**100%**

The WMO Global Workforce numbers that indicate a need for training are depicted in the following table.

Table 2. Global NMHS staff in job categories, and the number and percentage that require training

Job Category	Global Staff Numbers	Number That Need Trained	Percent of Current Staff
Managers	14,016	3,678	26%
Meteorologists	30,088	9,835	33%
Met Techs	41,130	12,253	30%
Hydrologists	2,492	724	29%
Hydro Techs	2,955	603	20%
Climatologists	10,684	3,195	30%
Researchers	15,286	4,464	29%
Support Staff	13,430	3,041	23%
Other	11,163	1,512	14%
Totals	**141,244**	**39,305**	**28%**

As indicated in Table 2, the training demand is quite large for the National Training Centres, the WMO Regional Training Centres and the Affiliated Training Institutions. Based on current performance, the existing training infrastructure does not have the capacity to meet all the training demands specified in the above table. In appendix A, there is a detailed discussion of the funding expectations for supporting the training demand globally and regionally. The combination of the rising expectations for extra-regional funding and the limited capacity within the RTC network will limit the ability to provide needed training. Thus, additional training capacity is needed to ensure that each training requirement for NMHS personnel is met. Additionally, the rapid advances in numerical weather prediction, remote sensing capabilities and the ever-increasing volume of observation data require continual updates for training materials and the operational NMHS workforce.

One of the primary challenges for learning and development in National Meteorological and Hydrological Services (NMHSs), National and Regional Training Centres and other training institutions that serve WMO Members is to keep up with the pace of change in the tools, techniques and services available to the WMO workforce. It goes without saying that the modern NMHS work environment is continually under the stress of integrating innovative technology. In many locations, employees can access alternative sources of information and training instantly.

For many years, the lack of internet access in developing countries led to significant investments in training for personnel outside the home country. Table 3: shows the increasing availability of internet within the developing regions and the more substantial increases that have occurred in Africa and the Asia Pacific region over the past five years. If we extrapolate these trends, the restrictions to learning options due to lack of internet access will decrease dramatically by 2025.

Table 3: Table showing the growth in internet access by region over the past ten years

	2005	2010	2016[a]
Africa	2%	10%	25%
Americas	36%	49%	65%
Arab States	8%	26%	42%
Asia and Pacific	9%	23%	42%
Commonwealth of Independent States	10%	34%	67%
Europe	46%	67%	79%

[a] Estimate.

Source: International Telecommunication Union.[7]

The national training centres, RTCs and Affiliated Training Institutions are making some headway toward implementing new learning technologies, but some organizations are still limited in their ability to respond. They may be bound by decades-old training approaches involving lengthy, one-off courses delivered using antiquated tools. Training centres may rely on lecture and recorded lectures to deliver training combined, in the best cases, with lab exercises and perhaps homework for their distance courses. Many of these courses are organized around topics rather than the competencies their staff are supposed to possess. As a result, trainees find it difficult to see how their training will relate to the job they are expected to perform

2.2 The changing training landscape

To meet the growing training demands, a recent survey in the United States (Axonify, 2017) indicates that the training landscape is changing and training process must adapt to the new learning demands and learning delivery requirements. While these statistics reflect only the current population in the USA, similar trends are occurring throughout the world. The survey asked workers which elements of formal workplace training are most important to them:

- 90 percent place training that is easy to complete and understand at the top of their list.
- 85 percent say it should also be engaging, fun, personalized and relevant.
- 72 percent want training that is regular and frequent.
- 63 percent say training should be short and that they should have the option to participate on a range of devices, including their smartphone.
- 64 percent want the choice to pick training times that work best for their schedule.
- 64 percent desire ready access to information anytime and anywhere they need it.

To expand training capacity, we must explore new methods for training delivery, yet national and Regional Training Centres are often bound by training approaches involving lengthy, one-off courses delivered in person to a limited number of participants, or online through learning management systems (LMS), without carefully considering or measuring if these courses effectively meet well-defined learning needs. As a result, there is no way for participants or their managers to know which training will improve forecast quality and services. Any increases in training capacity must be accompanied by quality assurance processes and guidance on learning paths.

In the Axonify survey (2017) half of the respondents reported that training made no difference to their performance of their job. Clearly, there is a wasted opportunity and investment if half of those who do receive scarce training opportunities find them a waste of time. The results of the Axonify survey give WMO members some insight into future modifications needed to make critical training available to more learners, developed and delivered by qualified training staff, not just in one-off courses, but at any location and at any time to enable employees to develop a continuous learning culture.

Imagine the potential impact of a near future in which:

- Prioritize learning needs are defined at regional and national levels to guide training decisions.
- Developing professionals are told clearly what new skills and background knowledge will help them progress in their careers.
- Learners have guided access to resources for self-study to help them progress down this path and to prepare them for more in-depth study. These are available on many platforms, at work, at home, in transit, and on desktop and mobile devices.
- By using pre-course online resources or online courses phases, learners come prepared for training events, either in person and online, having sufficient common background knowledge to engage at similar levels.
- Learners have the means to maintain continuous communications with fellow professionals at all levels to ask questions and to share their growing knowledge and work experiences.
- Learners and their managers know effective paths to follow for continuous learning and where to access the resources, including training events and self-directed resources, to help them.
- Training providers have guidance and resources that help them decide what to teach and recommendations on how to teach it, what and how to assess, and how to use a variety of methods to reach their training goals in all service areas.
- Assessments and certificate information tell learners and their managers what skills their staff members have learned in a training event.
- Training evaluations are administered to help improve resources and courses, both immediately following events and at a delayed interval to measure long-term retention and application of learning.

2.3 Meeting the challenges ahead

As shown in this section and in Appendix A, there are demographic, funding and training capacity challenges that require WMO members to apply new learning methods and technologies to increase the training available to our workforces. The funding challenges further increase our need to work collaboratively and to find innovative ways to leverage others learning content and methods. The increasing competency-based training requirements, the adoption of learner-centred training methods, and training available on many types of learning platforms creates new opportunities. We must continue to improve classroom-based instruction as well as increase our use of alternative learning solutions.

The recent efforts within WMO ETRP to support a demonstration project for the WMO Global Campus can help with some of these issues. However, a thorough review of the issues discussed in current

literature will provide a good basis for evaluating and making appropriate recommendations for ways to improve and increase the training capacity available to WMO members.

3. Challenges, trends, and emerging issues

In this section, a summary of relevant research and conclusions associated with increased access to high quality training is provided. The conclusions are focused on being prepared for the coming changes needed to support education and training over the next decade.

3.1 Investment in learning and development

At the national and international level, NMHS's in most WMO Regions believe that most of their training needs will be funded (See Appendix B). There are over 19,000 individuals worldwide that require training and there are expectations for funding to meet most of this training demand. However, the planned funding sources are all facing fiscal pressure to reduce spending which may require delays in training and increase the training gap within WMO Member workforces.

It is important to realize there is a training gap in current WMO NMHS workforce. It is also important for each National, Regional or supporting training institution professional to promote training and request their organisation to invest in training development and delivery to close this gap.

Consider the relevance to WMO Members of these US statistics quoted by O'Donnell (2017):

- The 2015 Manpower Talent Shortage Survey indicated that only 20 percent of organizations in the United States of America offered training to their employees.
- In the latest PricewaterhouseCoopers survey of nearly 1,350 CEOs, 73 percent ranked skill shortages as the greatest threat to their companies, a 10 percent jump from the 2014 results.
- Deloitte's 2015 Global Human Capital Trends report found that 85 percent of the 3,300 business and HR executives surveyed rated the talent challenge as "very important" or "important," a 21 percent increase from 2014's results. However, only 28 percent of those surveyed said their businesses are prepared to deal with this talent deficit.

In WMO meetings in all regions, the shortage of investments in training, skill or competency are recognized. NMHS's must see investment in human capital as a key management strategy that will improve productivity, performance and quality.

3.2 An Engaged Workforce

Effective training engages and motivates employees by showing them that their NMHS values them. Accordingly, organizations who invest in employees' education usually have a lower turnover rate. According to Ashley (2015), employee engagement is "the extent to which employees feel passionate about their jobs, are committed to the organization and put discretionary effort into their work." Maximum employee engagement should be every NMHS leader's goal. Employees who are passionate about their job, are committed to the organization and put the most effort possible into their work will produce a higher quality and quantity of work, translating to an increase in quality and services provided by the NMHS's.

Developing engaged employees begins with helping them understand how training will benefit them, and the NMHS, in the long run. Stressing the personal value of what employees need to learn, such as the potential for future promotion, can increase their willingness to become active learners.

Within WMO Member organizations, resources to support training are continually stressed beyond the demand, yet retaining trained staff is critical to maintaining competency within Member NMHSs. In NMHS's, investments often take several years before showing a return; however, NMHSs could see

the return on their training investment much sooner if the right metrics are collected and monitored. An engaged and competent workface has unlimited potential for producing top quality forecast and warning services, if the workers continue to stay passionate and committed to the mission. Training professionals must also stay engaged, dedicated and passionate about their job and profession to help their NMHS's stay current in times of constantly changing tools and services to the public.

3.3 Assessing learning needs

Needs assessments are a critical step in determining where the largest training gaps and highest priorities are within NMHS's. WMO Member NMHS's must determine the gaps are in the knowledge and competencies of their employees. Needs assessment help to identify weak areas and determine what training is necessary to develop competencies at WMO standards. Reviewing each employee's performance on a regular basis (annually or semi-annually) will provide additional information related to gaps in skill. Once you are aware of those gaps in the context of organizational priorities, job duties, and personal development, you can then determine the best education and training options within available budgets.

A critical first step in increasing training capacity is to determine the regional and national training needs and focus the investments in training on the most critical gaps. Morris and Kemp (2001), suggest that needs assessments are "a tool for identifying the problem and then selecting an appropriate intervention. If the (instructional) designer fails to identify the problem properly, then the intervention may address only the symptoms, with no resultant change in the target audience's performance." According to Morris and Kemp, needs assessments should perform four functions:

1. Identify problems affecting performance jobs or tasks
2. Identify critical needs that have a significant fiscal impact, affect safety, or disrupt the work or educational environment.
3. Set priorities for selecting an intervention, such as a training event or programme or on-the job coaching.
4. Provide baseline data to assess the effectiveness of the Intervention.

Without needs assessments reports that describe the required performance outcomes and standards to properly perform the tasks, instructional designers must rely solely on subject matter experts to define training requirements, which may lead to the unnecessary expense of developing training materials that go beyond the training required to meet the performance gap.

A complete training needs assessment process should determine who needs training, what kind of training they need, where they need it and how much it will cost.

There are nine steps to a training needs assessment:

1. Determine the desired performance outcomes.
2. Link desired business outcomes with employee behaviours.
3. Identify trainable competencies.
4. Evaluate current competencies.
5. Determine performance gaps.
6. Prioritize training needs.
7. Determine how and where to train.
8. Conduct a cost-benefit analysis.
9. Plan for training evaluation (to determine if needs are met).

A critical step in the process is to determine how and where the training should occur. To make this determination, we need to answer questions such as:

- Who is the audience?
- Where are they located?
- Are they entry-level, mid-level, experts or managers?
- What is the subject matter?
- What is the budget available?

The answers to these questions can help determine whether to traini locally, at a national centre, online, with self-directed online resources, or using a mixture of these. With improvements in technology, it's now easier to use a variety of training models that cater to a variety of learning styles.

3.4 Alternative sources for learning

In the tight funding environments in most NMHS's, selecting the right training approach to meet the identified gaps is critical. As technology, tools and forecast and warning processes change and the amount of data available to the forecaster grows, training methodologies must evolve as well.

3.4.1 Learning Outside the NMHS or National Training Centre

There are many training options to pursue outside the NMHS or National Training Centre. For example, national meteorology societies and other industry trade associations often offer free or low-cost training. Participation in conferences, seminars and meetings also present venues for learning, albeit at cost. WMO Regional Training Centres and Other International Training Organizations supporting the WMO provide opportunities for training and offer models for NMHS to use to conduct their own training.

3.4.2 Pairing Employees –

In the 1980's, McCall, Lombardo and Eichinger (1996) developed the 70- 20-10 model for learning and development in the workplace (McCall, Lombardo and Eichinger (1996) and Wikipedia, (2017)). The model suggests that 70 percent of professional learning occurs through application on the job, 20 percent occurs through peer coaching and collaborative learning in the workplace and only 10 percent of learning occurs through formal instruction. Exploiting this model, in-house, employee-led training can produce significant learning at a low cost. A peer coaching model will add further learning for employee development and helps to build a team approach to developing forecast and warning services. Employees with specific skills can transfer their knowledge to others, and when leaders, managers and staff members attend training programs, they can be asked to pass on what they learn to their team members.

3.4.3 Exploring Service Provider Packages –

Following the WMO Capacity Development goals, when new tools and products are provided to members, the supplier should offer training offer training packages to the national and regional training centres to help the recipients understand their proper utilization and to maintain the systems once the supplier's contract ends. This technical training could involve training away from the office, online training or webinars.

3.5 Cultural and technological transformation

Because of the large expense associated with some of the more progressive learning approaches, many learning institutions must become more collaborative in the way they approach training development. A cultural transformation is needed to both accept the new learning approaches and to increased collaboration for national and regional training centres. Additional, new tools are required to enable these centres to identify needs assessment gaps and share existing content and tools for rapid integration of existing content from multiple sources. To promote the development of new teaching approaches, processes for working collaboratively must be structured in ways that promote the exchange of new ideas and successful models and reward successful teaching innovations.

3.5.1 Competency frameworks and competency assessment

The WMO move toward competencies and Certification of Competencies, according to standards first called for by the International Civilian Aviation Organization for Aeronautical Meteorology personnel, is focused on augmenting academic knowledge with training to develop real-world skills that bolster NHMS capacity development. Training Institutions supporting WMO Members have a responsibility to deliver deeper, more active learning experiences and competency-based training that integrates the technology that the students will use in the workplace in meaningful ways.

But first, WMO Members need to develop and share competency assessment best practices and tools that identify competency gaps of the workforce. A WMO Guide on Competency (in preparation) will be published in 2017 that good practices on competency assessment, but each Member will be responsible for establishing its own systems and priorities. Together, we should work collaboratively to ensure a focus on competency assessment in addition to training.

3.5.2 Competency-based learning

Once competency gaps are defined, training that addresses these gaps is required. Competency-based training is focused on directly improving the organization's ability to provide services and products. A focus on competency is different than the dominant educational paradigm of structuring training around topics.

Competency is skills & knowledge applied in job contexts. For example, in meteorology, students learn about moisture, condensation, temperature, air masses and fronts, forecasting, thunderstorms and tornadoes and so on. With performance providing the structure, we use the tasks that need to be performed to organize the content. To make a forecast one needs to monitor the moisture, temperature, and stability; analyse air masses and fronts, and issue forecasts for tornadoes and t-storms. The knowledge is embedded within the real-life problem the learners are solving.

Allen (2012) suggests that in competency based learning design, training must be concise, meaningful, memorable, motivational, and measurable. The design must include placing the learner within a performance based scenario that is similar to what will be experienced on the job and aligned to organizational practices and objectives. The learning must be challenging and aligned to the real-life activities. The learning must provide feedback to learners through both consequences of their actions and decisions in practical situations. Consultation with operational experts is required during development of the training to ensure that real-world skills are being taught and assessed.

In many contexts, training technologies that focus on ongoing learning measurement and are adaptable to individual learning needs and speeds, are personalizing student learning experiences. Such technologies will help training providers evaluate the acquisition of competencies.

These days, competency-based learning also begins during formal education. Competency-based education (CBE) awards academic credit based on mastery of clearly defined competencies. CBE stands in contrast to education in which learning is structured around seat time and the credit hour.

With CBE, learners take as much or as little time as they need to understand the material and master skills. Competency-based programs can recognize prior learning and learning outside the scope of a course, regardless of where, when, or how that learning took place. CBE shifts the focus from grades to learning, emphasizing frequent, meaningful feedback that empowers students to take more responsibility for learning than in conventional models Educause (2014).

3.5.3 Online self-directed and just-in-time learning

Developing training under austere budgets requires utilizing all available training resources. The internet provides access to learning opportunities that can be very effective, as well as inexpensive or free. Of course, all such open educational resources (OERs) were developed at a cost by their originating institutions, with institutional or grant funding, or by individual experts expending their own time to offer them. But with open copyright licenses, such as those developed by the Creative Commons, they can be made widely and freely available. Such free offerings can benefit developers by a promoting their reputation, demonstrating their offerings, or for the altruistic reward of contributing to the discipline.

In areas where reliable internet is not available, online learning can be provided via DVD, CD-ROM and thumb drives that require only a computer to access learning. The key advantages to this style of learning are 24/7 availability, flexible timing, the option to meet various levels of need, and, in some cases, the ability to monitor progress and performance through verification of course completion certificates and pre- and post-test scores. The key disadvantages are the lack of real-time answers to questions or clarifications of content, but this can be mitigated through peer- and trainer-led discussion forums. This style of learning can also allow near real-time application on the job to ensure retention and relevance. Workplace learners want training content that is relevant and specific to the daily tasks performed and can be immediately applied. On-demand training models that allow learners to "pull" training content when and where it is required should be fundamental to future training design. Institutions must have robust strategies for integrating the online, mobile, and blended learning approaches now pervasive in many countries. A key ingredient is tracking how these approaches are actively enriching learning outcomes. Within developing countries, least developed countries and small island developing states, gaps still exist in access to reliable internet services. We must be flexible enough to support both the connected and unconnected training world. We need innovative practices that allow for both online and local access to training materials, yet also be prepared as the internet gaps close over the next decade and the potential of online, mobile and blended learning grows. –

In using open content and applying tools and training deliveryplatforms like LMS, educators will want to unbundle and adapt them in unique and compelling ways. To meet this desire, we should provide new tools and processes that allow for dynamic reuse, and develop shared resources with reuse in mind.

3.5.4 Online education and training environments

When a high degree of interaction is essential, facilitated online instruction can be used to save costs but preserve the required feedback potential. Facilitated online instruction has several key activities facilitators must undertake to ensure success;

1. Build an active learning team: Motivate learners to work together.
2. Be the leader of the learning team: Model what a good team participant should do, as well as take leadership to move if forward.
3. Maximize communication: Work actively to avoid feelings of isolation.
4. Deal with learning team conflicts immediately: Resolve the problems with interpersonal relations that can occur online.
5. Monitor student progress and provide frequent feedback: Just as you would in a face-to-face environment

Many useful resources on the online teaching experience can be found in the WMO Trainer Resources Portal at http://etrp.wmo.int/moodle/course/view.php?id=30 (in preparation).

3.5.5 Blended learning solutions

By utilizing many types of training and focusing your resources on the highest priority gaps, learning needs can be met more efficiently. Classroom training offers clear benefits for addressing many learning needs, but facilitated online learning and self-directed learning offer benefits that can complement those of the classroom. Training providers should consider all potential learning solutions to find the most effective and affordable methods for reaching those in need of training.

3.5.6 Increasing learning motivation through games, simulations, and gamification

A growing trend in training for competency-oriented learning outcomes is learning through simulations. The use of case study-based simulations reinforces competency development by offering practice that calls for the same level of analysis and decision-making required on the job. These simulations can be simple paper based exercises that review forecast processes and are conducted under very short timelines. More complex online simulations can also be conducted that utilize computer software to simulate numerous aspects of NMHS forecast office simultaneously. Tools for developing low-cost simulations in meteorology should be made available in the near future.

Simulation can also be used in assessment. For example, both the KMNI and the Australian Bureau of Meteorology uses a severe weather forecast process simulator to certify their NMHS staff. The simulator allows someone in Melbourne to logon to a learner's computer in another city in Australia and to conduct a learning simulation based on historical cases that are shared electronically.

Learning through games is also a growing trend in training and higher education. Games can also be, and indeed the concepts overlap. The wide-spread popularity of games (larger even the movie industry) has led educators to examine the qualities of games that lead to such high levels of engagement, and find ways to include games oriented to learning content and skills among their learning activities. The key is to make the learning fun, but to also align the game outcomes toward practical learning outcomes. Learning through games and simulation can improve learner engagement and retention and provide instant feedback and self-diagnostics. Games and simulation, if done offline, do not required large investments but do require an understanding of instructional design and game theory to design well sequenced learning events.

Gamification is a term used to describe the application of game-design elements and game principles in non-game contexts. The goal is the improve engagement through the use of techniques that utilize motivation and engagement strategies similar to those used in games. Educators can use gamification by creating friendly competition among learners, issuing badges for incremental achievements, using online avatars as support, defining learning paths with levels to be achieved, rewards and many kinds of challenges. (Oesch, 2017).

There are a growing number of gamification platforms such as Badgeville, BigDoor or GetBadges, which have a wide range costs, depending on their clients' needs. Moodle, Zero and User Infuser are free open-source learning platforms with gamification capabilities.

4. Conclusions: Promoting a learning culture transformation

In Section 3 we explored challenges, trends and issues associated with the changing training landscape. In this section, we will draw several key conclusions.

1. WMO Members should work to increase the visibility and recognition of the value of training for continuing to develop and deliver their services. Investment in training is often not sufficiently considered.

2. NMHS workforces show a high and increasing demand for training with increased development and changing work processes, tools and services.

3. The growth in internet access around the globe is creating new avenues to help meet training needs.

4. Investments in training to develop a competent workforce is critical to service delivery.

5. Needs assessments and competency assessments are critical for determining training priorities, especially under the constraints of limited budgets and timeframes.

6. Competency based training that is aligned to WMO Member NMHS performance requirements is critical for increasing the impacts of training.

7. Training institutions now have available new and alternative training sources and alternative processes that include integration of new learning technologies, simulations and competency-based learning activities.

8. Utilizing online learning increases the numbers of students that can access critical courses and resources.

9. The use of learning games and gamification strategies can enhance and sustain learning engagement.

10. Collaboration is key for scaling effective solutions to serve many Members. - The WMO Global Campus initiative can be used to develop an ETR Community of Practice to foster collaboration and sharing.

In fact, many of the conclusions in this section are reasons behind the development of the WMO Global Campus initiative, current in feasibility study.

The WMO Global Campus Feasibility Study is being conducted to investigate methods to increase training capacity within the WMO through expanded support for the WMO Regional Training Centres and other WMO training partners. The vision of the Global Campus Concept was defined in the first year of the study:

> *The 'Global Campus' is a collaborative network of education and training institutions and NMHSs involved in the development and delivery of training in meteorology, climatology, hydrology and other related sciences. It is built on the synergies, sharing and cooperation between these institutions and will address global priorities and the growing and changing requirements and needs for training of the community.*

The concept behind the WMO Global Campus is to have a coordinated and collaborative network of institutions that work together to meet the education and training needs of WMO Members. It will build upon the existing network of RTCs, but expand this network to further recognize other contributing national and international organizations and academic institutions, promote the use of new training delivery mechanisms, and focus on new and emerging training needs. The WMO Global Campus framework will provide a coordination and communication system, as well as associated information and data tools that will enhance the sharing of resources, knowledge and expertise, and the efficiency and effectiveness of the overall network.

A future WMO Global Campus could offer a catalogue of learning content resources in multiple languages that is searchable and available for:
- Developing locally produced instructor lead courses
- Refresher material at point of application
- Competency assessment or refresher material supporting competency assessment
- Foundational materials for academic institutions
- Learning content to be available on mobile and handheld devices to all learning opportunities.

One of the missions of the WMO ETR Office is dissemination of good practices through human resource exchanges and promotion of stronger connections with WMO technical and research programme. These strategic partnerships are critical to the expansion of training capacity throughout WMO Members. The WMO Global Campus initiative is itself a partnership supporting innovation and new partnerships.

The WMO Global Campus initiative will assist the WMO Secretariat in its work to ensure all Members meet the standards and practices described in WMO Technical Regulations by offering more avenues for guidance and training. It will support the WMO Technical Commissions and Technical Programmes by providing greater access to the courses and resources they promote to meet their strategic objectives. In addition, the strengthened collaborative training network that is created can aid in identifying training needs, creating effective training solutions, and generating cost-saving partnerships for meeting these objectives.

5. Recommendations

SYMET should consider the following recommendations based upon the conclusions drawn from the preceding discussion. Additional recommendations or revision of these is expected to result from online and symposium discussions.

    a. Recommendations for training institutions include:

        i. Engaging with their regions to understand the outcomes of regional needs assessments, and aligning training appropriately.

        ii. Participating in innovation projects that seek to utilize new and alternative training methods.

        iii. When appropriate, aligning training with WMO competency frameworks, as described in the WMO Guide on Competency (in preparation).

        iv. Exploring increased utilization of online learning, blended instruction and self-directed study.

        v. Seeking opportunities to implement simulations and games to support attainment of WMO competencies.

        vi. Participating in the WMO Global Campus initiative by sharing and utilizing shared resources and promoting courses through the WMOLearn Events calendar.

    b. Recommendations for the WMO Secretariat and Technical Commissions include:

    i.   Helping members in the utilization of learning needs assessments and aligning its investments in training courses and fellowships with documented needs.

    ii.   Working with WMO Boards and Commissions to sponsor projects that seek to utilize new and alternative training methods.

    iii.   Working to ensure that training courses and resources are designed as competency-based training, when appropriate.

    iv.   Supporting training organizations to increase their utilization of online learning, blended instruction and self-directed study.

    v.   Working to ensure sponsorship for innovation projects that support increase use of simulations and games to support attainment of WMO competencies.

    vi.   Expand the ETR community of practice through further development of the WMO Global Campus initiative and other multidisciplinary leadership groups to help keep pace with the rapidly changing training context.

    vii.   Working with WMO Members and Donors to engage with tool providers to provide the training necessary to implement new technologies by recipient NMHSs

c. Recommendations for development partners and international organizations:

    i.   Supporting development goals that are aligning with documented learning needs.

    ii.   Sponsoring innovation projects that seek to utilize new and alternative training methods.

    iii.   Sponsoring capacity development projects that include helping countries become aligned with WMO Qualifications and Competency Standards, as defined in the WMO Technical Regulations.

    iv.   Including the WMO Global Campus initiative as a potential aid for meeting capacity development needs.

    v.   Asking tool developers to provide the training necessary to implement new technologies by recipient NMHSs

Appendix A. Sources Reviewed for this Paper.

Allen, M (2012). Leaving ADDIE for SAM: An Agile Model for Developing the Best Learning Experiences. American Society for Training and Development, Sep 26, 2012 - Business & Economics - 216 pages

Axonify (2017). Axonify Announces Workplace Research That Reveals One-Third Of US Employees Receive No Formal Job Training, TD Magazine Wednesday, February 01, 2017

Bingham, T. and Glagan, P. (2017). A View From the Top, Wednesday, February 01, 2017

Casey, A (2015). How to Empower Your Employees to Give Their Best. TD Magazine, Thursday, November 19, 2015

Educause (2014). ELI 7 Seven Things You Should Know About". www.education.edu/ELI, February 2014.

Huhman, H.R. (2015). Ensuring the Effectiveness of Training. Summarized Monday, November 30, 2015

McCall, M., Lombardo, M. M., and Echinger, R. W. (1980's). *The Career Architect Development Planner (1st ed.). Minneapolis: Lominger. p. iv. ISBN 0-9655712-1-1.*

Morrison, G., Ross, S., and Kemp, J. (2001). Designing Effective Instruction. New York: John Wiley and Sons, Inc.

O'Donnell, B. (2016). Using Training Needs Analysis to Choose Between Local and National Training. Training Industry Magazine, December 22, 2016

Oesch, T., (2017). 5 Tips for Using Game Mechanics to Drive Learner Engagement. TD Magazine, Thursday, February 02, 2017.

Ross-Lazarov, S and Ross-Lazarov, R (2017). WMO Workforce Survey Report. Draft

Wikipedia (2017), The 70, 20, 10 training model. Found at https://en.wikipedia.org/wiki/70/20/10_Model#cite_note-Lombardo-1

WMO Global Campus Roadmap (2017). WMO Global Campus Roadmap, Version 2.13

Appendix B: Global and Regional Training Funding Assessment Discussion

The following table shows the global number of people that respondents anticipate will train in 2017, with the support of one of four funding sources: government, project funds, WMO, and other scholarships.

Table1. Global expectations for training support, 2017

Funding source	Number of Staff Anticipating Training	% of the Total Nr of Staff Anticipating Support
Government	16,072	84%
Project Funds	1,421	7%
WMO	1,162	6%
Other Scholarships	536	3%
Total	19,191	100%

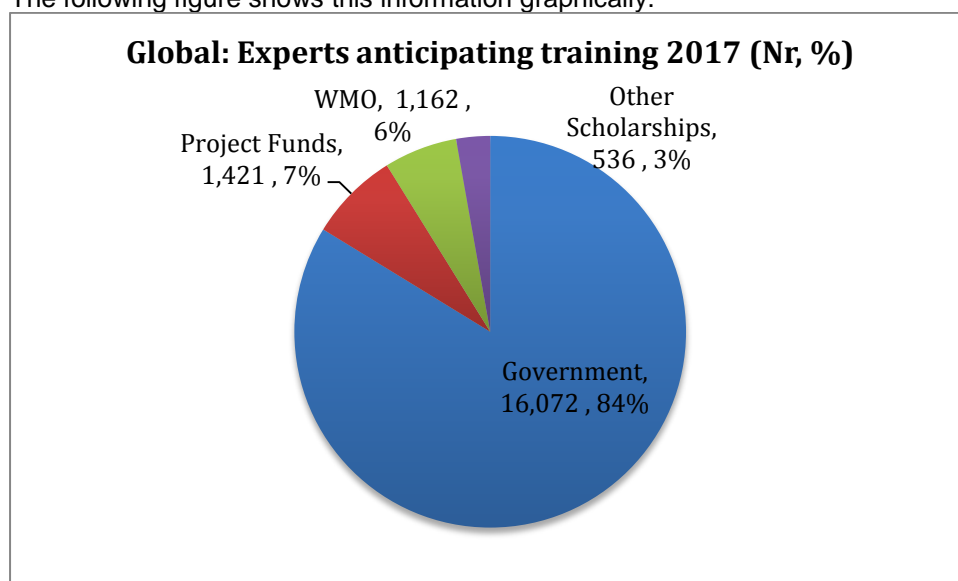The following figure shows this information graphically.

Figure2. Global number and percentages of experts anticipating training in 2017, by funding source

About 19,000 people hope to train in 2017. Funding for the large majority (84%) of these 2017-trainees is expected to come from government sources. Project funds are expected to cover the training for about 1,400 people, or 7% of the 2017-trainees. The WMO is expected to fund about 1,200 people's training (6% of those anticipating training). Finally, other scholarships are expected to provide funds for an additional 540 people (3% of the 2017-trainees).

When the average global percentages are calculated based on the Members' national percentage distributions, the resulting patterns of funding-source distribution are quite different, as shown in the following figure. (Respondents that did not enter numbers for experts anticipating training in 2017 were omitted from the averaging calculation.)
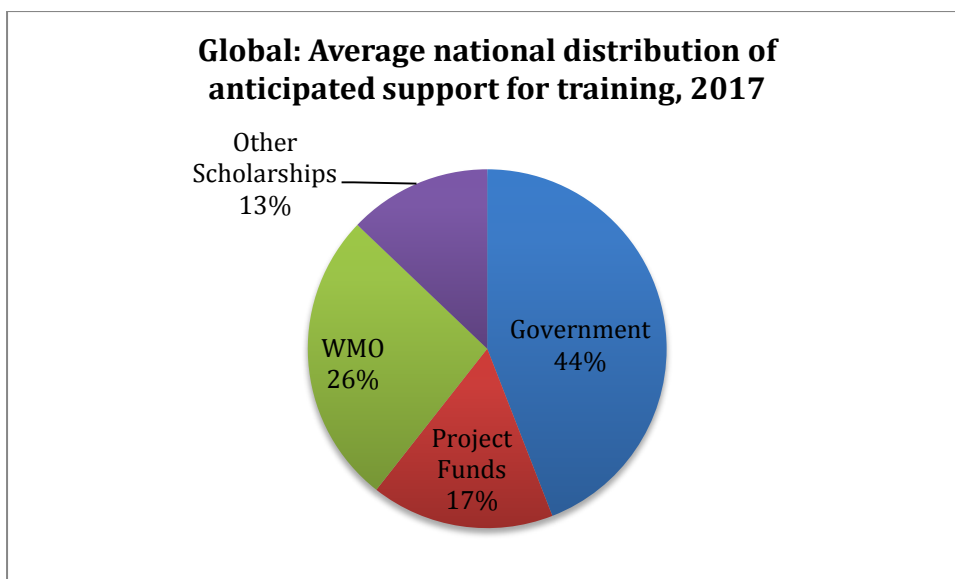
Figure 3. Global: Average distribution of anticipated support for training for 2017, based on Members' national distributions

On average, respondents anticipate that 44% of their 2017-trainees will receive their funding from government sources, 26% from the WMO, 17% from project funds, and 13% from other scholarships.

Regional numbers of 2017-trainees

The following table shows the total numbers of people anticipating training in 2017 in each Region.

Table 2. Regional numbers of staff expecting to be trained in 2017

Region	Number of People Anticipating Training	Percent of global total
I	3,101	16%
II	5,046	26%
III	846	4%
IV	4,734	25%
V	1,035	5%
VI	4,429	23%
Global total	19,191	100%

- 5,000 people in RA II are hoping to train in 2017. This is 26% of the 19,000-people hoping to train.

- 4,700 people in RA IV are hoping to train in 2017. This is 24% of the 19,000-people hoping to train.

- 4,400 2017-trainee hopefuls work in RA VI (23% of the global group).

- (Thus, about one-quarter of the 2017-trainees work in each of RA II, RA IV, and RA VI, totaling to almost three-fourths of the 2017-trainees.)

- 3,100 of the 2017-trainee hopefuls work in RA I (16% of the global group).

- 1,000 people in RA IV hope to be a 2017-trainee (5% of the global group).

- Finally, 850 2017-trainee hopefuls work in RA III (4% of the global group).

Regional 2017-trainees and funding sources

The following table shows the number of 2017-trainees in each Region that are anticipating support from each funding source.

Tabl3e. Regional numbers of staff anticipating training in 2017, by funding source

Funding Source	Region						Total by Source
	I	II	III	IV	V	VI	
Government	1,966	4,047	458	4,603	898	4,100	16,072
Project Funds	401	606	194	28	45	147	1,421
WMO	518	264	135	87	62	96	1,162
Other Scholarships	216	129	59	16	30	86	536
Regional Totals	**3,101**	**5,046**	**846**	**4,734**	**1,035**	**4,429**	**19,191**

The following figure shows this information graphically.
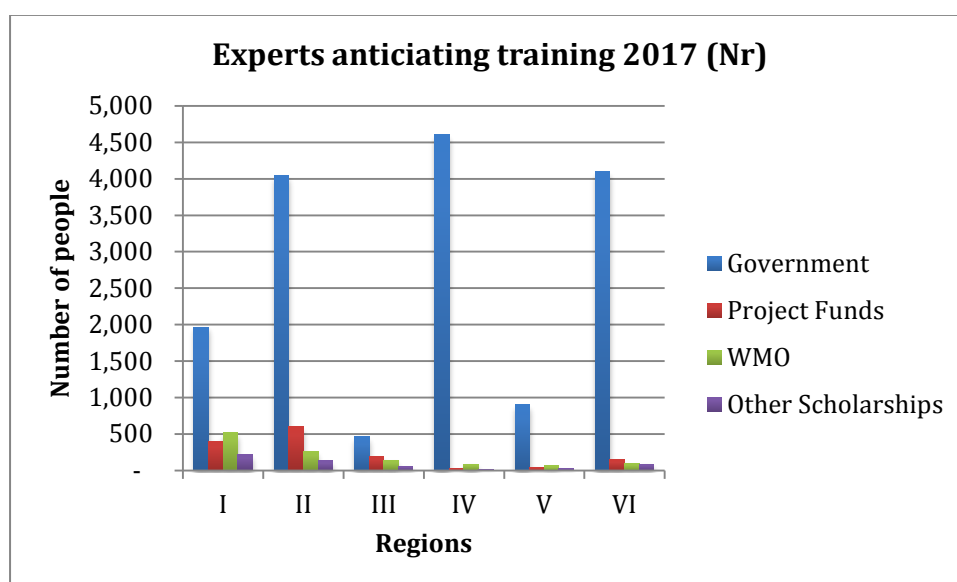
Figure 4. Regional numbers of staff anticipating training in 2017, by funding source

The next table shows the percentages of each Region's 2017-trainees that are anticipating support from each funding source. The information in this table provides insight into the balance of funding-source support each Region is anticipating. In other words, it provides insight into the mix of funding sources each Region is relying upon to fund their 2017-trainees.

Table3. Percentage of each Region's 2017-trainees anticipating funding from each source

Funding Source	Region						Global
	I	II	III	IV	V	VI	
Government	63%	80%	54%	97%	87%	93%	84%
Project Funds	13%	12%	23%	1%	4%	3%	7%
WMO	17%	5%	16%	2%	6%	2%	6%
Other Scholarships	7%	3%	7%	0.30%	3%	2%	3%
Total	100%	100%	100%	100%	100%	100%	100%

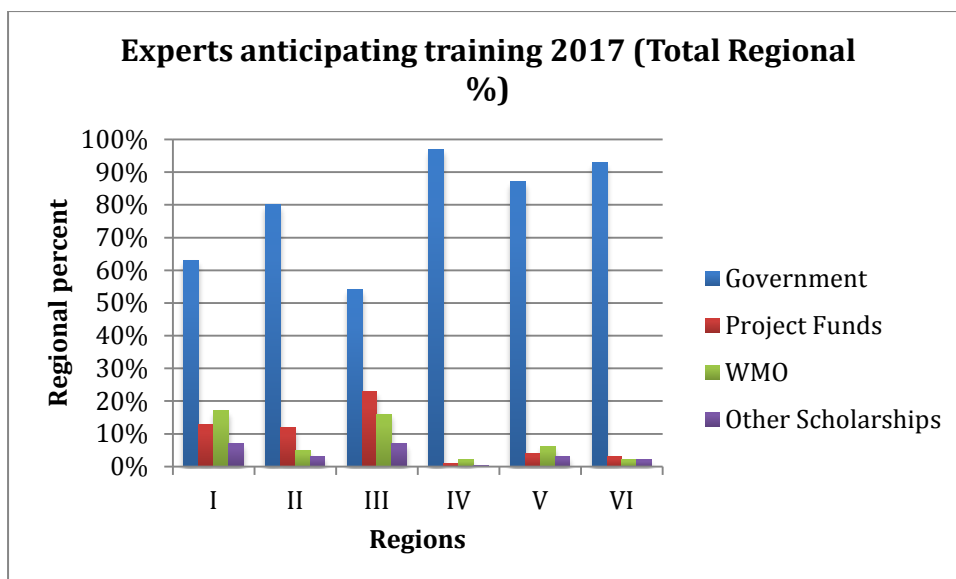The following figure shows this information graphically.

Figure 5. Regional percentages of experts anticipating training in 2017, by funding source

The above percentages, calculated based on the Regions' total numbers of experts anticipating training in 2017, are heavily influenced by the funding patterns anticipated by Members with large NMHSs. Several of these large NMHSs anticipate their governments to supply all or nearly all their training funding, thus raising the overall Regional percentages of funding expectations. Members that are included in this category include China in RA II (82% anticipated government funding), the United States in RA IV (100% anticipated government funding), Australia in RA V (100% anticipated government funding), and the Russian Federation in RA VI (100% anticipated government funding).

When the average Regional percentages are calculated based on the Members' national percentage distributions, the resulting patterns are quite different from the Regional totals, as shown in the following table.

(Respondents that did not enter numbers for experts anticipating training in 2017 were omitted from the averaging calculation.)

Table 4. Average percentage of Members' 2017-trainees anticipating funding from each source

Funding Source	Region						Global
	I	II	III	IV	V	VI	
Government	34%	54%	36%	44%	41%	52%	44%
Project Funds	17%	17%	16%	14%	12%	19%	17%
WMO	39%	19%	30%	26%	26%	17%	27%
Other Scholarships	10%	10%	17%	16%	21%	13%	13%
Total	100%	100%	100%	100%	100%	100%	100%

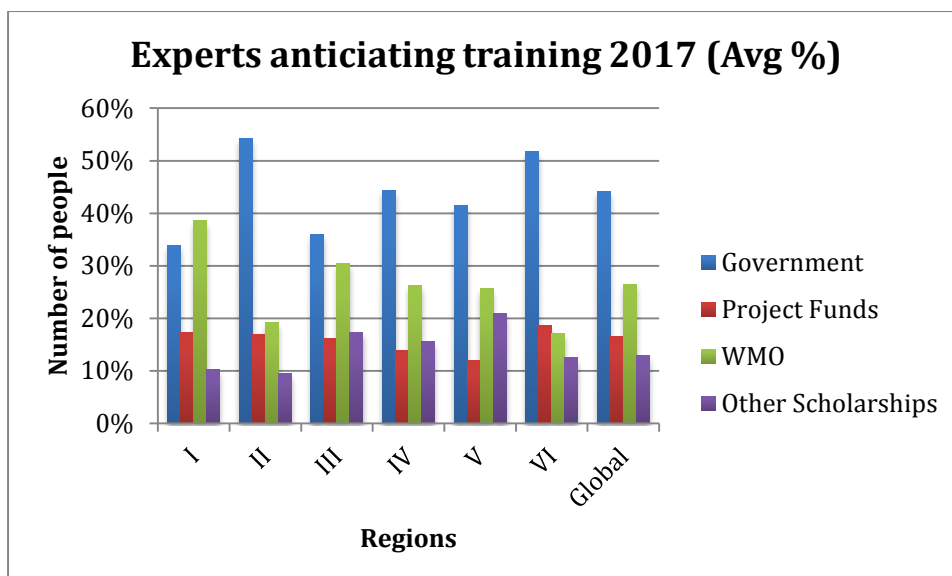The following figure shows this information graphically.

Figure 5. Average regional percentages of experts anticipating training in 2017, by funding source

The above table and figure show that on average, the Regional Members are supporting 34% to 54% of their 2017-trainees with government funds. The global average is 44%.

The governments of RA II and RA VI are supporting more than half of their experts anticipating training in 2017—the highest ratios among the Regions.

The governments of RA IV and RA V are both supporting more than 40% of the experts anticipating training in 2017.

The governments of RA I and RA III are both supporting more than 30% of the experts anticipating training in 2017.

The percentage of 2017-trainees anticipating support from project funds is well balanced among the Regions, when viewed from this perspective: on average, between 12%-17% of 2017-trainees in all Regions anticipate support from project funds.

On average, the WMO is anticipated to support a larger percentage of 2017-trainees in most Regions than it appears when viewed by the total Regional percentages. On average, more than 25% of 2017-trainees in RA I, RA III, RA IV, and RA V anticipate support from the WMO. The percentages of 2017-trainees in the other two Regions, RA II and RA V, are just under 20%.

The contribution other scholarships are anticipated to make to the support of 2017-trainees is also higher when viewed according to Member averages rather than by Regional totals. Based on the averages of their Members, all Regions anticipate 10%-21% of their 2017-trainees to find support from other scholarships[1].

---

[1] "Research prepared for the United Kingdom government found that companies with a highly engaged workforce experience a 19.2 percent growth in operating income over a 12-month period. Conversely, unengaged workers can cost an organization. McLean & Company found that a disengaged employee costs an organization approximately $3,400 for every $10,000 in annual salary. Disengaged employees cost the American economy up to $350 billion per year due to lost productivity." O'Donnell, 2017.[1]

Appendix C: Needed Attributes of Competency Based Education and Training

Concise, effective learning events, weather delivered through e-learning or not, are meaningful, memorable, and motivational. And they achieve measurable results, too."

"Meaningful - Meaningful learning events are those that assure learners can connect additional content to their current knowledge and skills. They make sure learners recognize 1) how do current skills may not be sufficient in certain circumstances and 2) what tasks they will be able to perform after skill enhancement."

"Memorable - What good is instruction if it is not remembered when the need to perform arises? Good learning events provide learners the ability to perform effectively at the time of most value." (p.22)
" Motivational - Motivated people find ways to learn what they need to learn to be successful. The hurtles they jump are proportional to their motivation, while there may be a fair amount of time lost to trial and error and they may not learn best practices, motivated people learn. Lesser motivated people have a rougher time, since learning depends on what learners do– what they attend to, what they think about, what they practice. They may just complete the minimum of what is expected of them, if that, and move on, greatly forgetting whatever learning occurred."

"Measurable - Effective learning events produce skills that can be observed. Of course, we all have skills we don't use or don't used enough. We can't know easily if an individual has the skill and isn't applying it. But we shouldn't assume people have acquired skills when we can't observe their abilities" (p.23), For learning to be meaningful, memorable, motivational and measurable, Allen suggests the following components of interactive learning:

Context - Context is the relevant situation and conditions a learner must consider when performing a task… Contexts are strong when they have relationships to real situations the learner will encounter, have fascinating attributes in them, and invite exploration for important but not so obvious details… without context, learners can be unsure of the personal relevance of the training to themselves. Enthusiasm and motivation decrease. Context is critical for meaningfulness. (p.24-25)

Challenge - Challenges spur learners to action and provide a wonderfully effective way of heightening motivation… effective challenges spur learners to re-examine the context and consider fully the probable outcomes of various responses. Just this in real life, we choose responses based on previous experience and knowledge. Will use the skills we presently have, and as we learn, modify them in hopes of achieving better results. Making mistakes and observing the consequences is a fundamental learning cycle, and by building challenges on relevant and authentic contexts, we enable this effective process.

Activity - **If we are teaching our learners to do things, they need to be doing things while they are learning**… Effective activities look and feel to learners like the real tasks they expect to be performing post training.

Feedback - There're two primary types of feedback: consequences and judgments. Consequences revealed two learners what would really happen in response to their actions or inactions. Feedback in the form of consequences complements authentic activities to make the event feel realistic... In general, good instruction events offer consequences in the most realistic ways possible and put forth judgments only after it has become apparent that the learner needs direction. (p. 26-27)

Link to competency and performance goals - When it comes to training, you need to define what your employees need to do to meet performance outcomes and links to KPIs and NMHS organizational objectives.

Consult with Subject Matter Experts - Subject matter experts (SMEs) are a valuable resource and through consultation, you can uncover what learners really need to know to improve competency.

Real-world skills are needed to ensure competence and employee development - The WMO move toward competencies and Certification of Competencies by the International Civilian Aviation Organization, is focused on aligning academic knowledge development with workplace learning to develop real-world skills and bolster NHMS capacity development. Learners expect that their investments in learning enable them to apply what they learn to their jobs (T&DM, 2017). Training Institutions supporting WMO Members have a responsibility to deliver deeper, active learning experiences and skills-based training that integrates the technology that the students will use in the workplace in meaningful ways.