Introduction

Gail Marshall and Mikko Ruohonen

In every culture telling stories about how events occur and why they occur is an important activity that distributes information and ensures a collective understanding. Similarly, gathering together to discuss issues and demonstrate skills is an age-old form of self and community development. So it was with the Harare conference. During the week of the conference, capacity building occurred daily as delegates shared their experiences with IT and worked together to forge a community of professionals dedicated to creating a hospitable and practical climate for IT in their own countries, and to continue sharing insights and expertise long after the conference ended.

Development is often thought of as a straightforward linear process - one starts from Ground Zero and quickly accumulates experience and expertise. In fact, development, whether of human beings or organizations, is a fitful process. Forward motion is unpredictable, and often accompanied by obstacles, wrong turns and regressions. The conference highlighted the fact that all countries are 'developing' with respect to IT use. New technologies, appearing almost daily, cause shifts in policies and practices, and call for reallocations of a wide range of resources. All countries are 'undeveloped' in the resources needed for IT adoption, implementation and institutionalisation since insufficient resources - time, money, expertise - are currently being allocated. This is as true in Paris as in Papua New Guinea.

The delegates recognized that while per capita income may be a dividing line separating 'developed' from 'developing' countries, the search for solutions to a host of common problems unites IT users around the globe. For example, IT adds a new level of complexity - acquiring equipment, training users and reconceptualising past practices - that places extraordinary demands on the IT community and, at the same time, creates dislocation in day-to-day life, whether in the village or the megalopolis.

The conference, with its attention to education from the preschool level to the workplace, impressed on the delegates the need to consider IT as an integral part of the educational process. Young children, it was said, need IT-based experiences to acquire literacy in the language of their country; mature workers, it was said, need IT-based experiences to equip them for the ever-changing workplace in Sydney Australia or Harare, Zimbabwe.

While each of us is a unique human being, we operate in a complex social context with established mores. Increasingly pressure, either from within or without, to incorporate skills and strategies necessary for survival and success is creating a demand for a wider use of IT in educational settings. As IT-using educators we know that teachers, school administrators and government officials must learn to use IT as part of educational practice. But the old ways - government

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policies and management principles, for example - constrain our ability to use IT to the fullest. Similarly, the complexity of IT integration - altering curriculum, reshaping teaching practices and developing software - acts as a brake on the straightforward, widespread use of IT around the globe.

Nevertheless, telling stories about large scale national projects and smaller but equally powerful initiatives as well as sharing experiences and making recommendations as occurred at the Harare conference serves not only the delegates to the CapBIT conference but also readers of the conference proceedings so they may cope more successfully with the complexity associated with IT adoption and institutionalisation, and thus assure the continuation of capacity building worldwide.

National perspectives

Peter Bollerslev, elected to the presidency of IFIP shortly after the Harare conference took place, discusses the Nordic countries' approach to capacity building for Information Technology. His analysis of the many and varied activities initiated by the members of the Nordic Committee on Educational Software and Technology highlights the importance of collaboration among countries. Bollerslev also shows us the role that shared culture and pedagogical traditions play in facilitating planning and practice. Strategies successfully employed in the Nordic region might provide a blueprint for other countries in a region as they proceed through IT adoption-implementation-institutionalization phases.

Sunday Ojo and Ben Awuah's case study of Botswana's plans and practices provides an interesting counterpoint to Bollerslev's story. Working with more limited resources than the Nordic countries, they, like their Nordic colleagues, realize the importance of curriculum building, teacher education and evaluation. Realistic in their appraisal of constraints facing them, they also look to a future in which IT plays a major role in the day-to-day lives of their countrymen.

Geoffrey Kiangi, from Namibia, while also emphasising the constraints facing many developing countries' attempts to integrate IT into education, says that social, vocational, pedagogical and catalytic factors compel policy makers in developing countries to plan for the widespread adoption of IT. So Kiangi, echoing themes articulated by Bollerslev, Ojo and Awuah, says emphasis must be placed on education, not technology. That message will resonate through the stories told in this volume.

The importance of teachers' collaboration on curriculum development and their active role in software development, described by Bollerslev as an important component of teachers' education about IT, receives confirmation in Hogenbirk's story. His description of an ambitious and successful project in The Netherlands shows that by enlisting teachers in the design of IT-based lessons, the revision of the curriculum to reflect the role of IT becomes a powerful tool for teacher education - not only for teachers who participated directly in the curriculum development process but also for their colleagues who watched the process and learned by working alongside their IT-innovating colleagues. Hogenbirk's discussion of the 'Schools with SPIRIT' project reminds us of the crucial role involved teachers play in the successful adoption of innovations.

Capacity building is and will be a continuous process. Sindre Røsvik tell us how Norway, which has been using IT in the classroom for many years, has embarked on a major school reform initiative in which IT plays a central role. Like The Netherlands's initiative, Norway's is comprehensive, but Røsvik questions whether financial resources and government plans for allocating responsibility are sufficient to ensure success of the reforms. The tension between what is planned and the resources allocated for the plans will be a theme that will be replayed again and again as commentators describe attempts at IT-based capacity building.

The importance of planning and the essential role that government plays in the process of initiating and institutionalizing IT in schools is reiterated by Alex Fung in his description of Hong Kong's present and future use of IT. While describing Hong Kong's plans for the installation of large scale information management systems, Fung also says that resource provisioning for educational management should not supersede strategic planning directed at developing peoples' capacity to use IT across a wide range of educational situations. The importance of a holistic view of IT in education, the key role that teacher education plays in the successful use of IT, the crucial role that government plays, and the positive impact of collaboration among all stakeholders are cited by Fung as essential elements in present and future capacity building.

Hari Gopal Shrestha's story of his work in Nepal on behalf of IT implementation and integration reminds us that collaboration and planning do not happen spontaneously. Instead they require patience, vigilance and persistence; they require the diligent efforts of one or more leaders who see what IT can do, mobilize forces to accomplish the vision, and then continue to share and shape the vision as new possibilities are presented by the emergence of new technologies. In each case - curriculum development, teacher education and resource provisioning, Shrestha had to take the initiative in order to promote the widespread adoption of IT in Nepal. Although he mentions support from colleagues in other countries, a critical ingredient in developing and maintaining one's own capacities, it is clear that Shrestha's 'on the ground' efforts were essential elements in the growth of IT use in education in Nepal. Many other participants in the Harare conference have experienced the isolation faced by Shrestha and combating isolation remains a major problem in IT-based capacity building. The end result, building the skills of a generation or more of students and teachers, is worth the price, according to Shrestha.

Building skills in the national context

Skills development is at the forefront of Arthur Sithole's discussion of Zimbabwe's plans for IT use. Stressing the need for his country to develop an IT-competent workforce, Sithole cites the need for strategic planning, the need to stimulate IT-focused training opportunities, and the need to continually monitor the processes and products of that training.

Uche Modum's description of Nigeria's efforts to work with IT emphasises the importance of a country's economic, social and political infrastructures as both constraints on capacity building and as necessary ingredients in the implementation of plans for broad-based IT use. Wealth of natural resources, says Modum, does not ensure the successful implementation of IT if political, social and economic

conditions are unfavourable at one or more points in time. Her analysis of Nigeria's past and present situation, where IT use has grown dramatically in spite of the economic downturn is inspiring; her view that Nigeria continues to face economic difficulties that will compromise future IT-based growth is a story familiar to many in the IT community.

Deane Arganbright's discussion of capacity building in Papua New Guinea shows the role that steady work and careful planning can play in developing a core of IT-enabled students. Working in a remote area of the world and challenged by limited financial resources as well as climatic constraints, Arganbright and his colleagues have developed a curriculum - based on applications programs - to train the workforce for today's and tomorrow's challenges. Emphasising problem solving as much as basic computer literacy, Arganbright's program is easily replicable and may serve as a model for other countries seeking to build IT-based competencies.

Targetted projects

Portable computers provide a strategy for implementing IT in situations where desktop computers may be impractical for one reason or another. Anne McDougall analyzes the implications of portable computers used as essential elements of an Australian school's IT strategy. When students use portable computers in each class throughout a school day, says McDougall, IT knowledge and skills improve, and so does cooperation among students. Better problem solving and increased student responsibility for learning can be seen where the portable computer is used as fluidly as the pencil. McDougall points out that the constraints associated with portable computer use - the need for battery charging, the cost of procurement and the staffs' anxiety about managing and using the computers - must be recognized but proposes that portable computers might be a viable way for many countries to enhance their IT-based capacity building.

Often IT adoption and implementation has been a helter-skelter process - a few computers installed and teachers trained haphazardly. Sam Gumbo describes a Zimbabwe-based project designed to bring coherence to schools' IT use. As part of the process of introducing IT to a group of schools in Zimbabwe, appropriate implementation strategies will be analyzed, and teacher training will be coordinated and evaluated as a new phase of capacity building begins in Zimbabwe.

New strategies for empowering school administrators to take a major role in planning for and using IT is the focus of Bil Newman's discussion of an Internet-based project for school principals in Australia. By teaching school principals located in the remote Australian outback how to access the Internet and use it as a means of school-to-school communication, the Australian Principals Association Professional Development Council has changed principals' attitudes towards IT and enhanced their ability to play a leadership role in IT-based decision making in their schools. The model has powerful implications for others working to develop capacities for IT use.

Zhang Ji-Ping and Jef Moonen present another facet of telecommunications as a tool for capacity building. By collaborating both face-to-face and over long distances via telecommunications, East China Normal University and the University of Twente, The Netherlands, have provided distance courses which will

eventually be used by 60 Chinese universities. The project, sponsored by AT&T, illustrates the tremendous potential of IT to put needed resources in place around the globe.

Not only for the here-and-now but for the future, telecommunications can be a powerful tool for linking people with one another. IT can also be a major ingredient in the development of positive attitudes towards lifelong learning. Anton Knierzinger's discussion of Upper Austria's 'Education Highway' project sets forth criteria for Internet use - learning will be more project-oriented, more problem-oriented and more activity-based. Specifying four essentials - time, motivation, sources of advice and evaluation/research - Knierzinger sets the stage for other countries to design and deliver similar projects as part of their capacity-building programs.

Classroom-based initiatives

Just as the 'Upper Austria' project recognizes how students can benefit from Internet use, Rachel Cohen sets out the strategies for using IT to prevent illiteracy among young children. Based on her carefully developed program of written and oral language development activities in French IT-equipped settings, Cohen provides a conceptual framework for young children's use of technology. She accompanies that framework with guidance on managing instruction for young children in IT-equipped classrooms. Her belief that early intervention is crucial for the full flowering of each child's potential is an important message for those seeking to use IT to create a major educational impact.

Márta Turcsányi-Szabó sees Logo as a powerful tool for increasing students' literacy with informatics. Knowing about the computer and knowing by using the computer, in her view, are complementary, and of equal importance. She describes how pre-service teachers can be shown how Logo can be used to convey important ideas, thus ensuring that teachers-to-be will use IT in educationally meaningful ways as soon as they begin their teaching careers. The curriculum developed at Loránd Eötvös University in Hungary may be adopted by others who wish to move from a computer literacy to a computer empowerment level of capacity building.

Research for IT-based education

Research on the essential elements of curriculum is the central issue in Mikko Ruohonen and Olayele Adelakun's paper. Taking the current level of curriculum development for IT in Nigerian universities as a starting point, the Finland-based researchers say that Information Systems education is vitally needed in developing countries in order to develop the necessary human resource capacities needed for current and future IT adoption and utilisation. Their recommendation for a model Information Systems curriculum is a valuable resource for any country, whatever its stage of capacity building.

Deryn Watson of the UK cautions us not to think that providing resources will translate into successful implementation. Citing numerous studies which describe the limited impact of IT on education, Watson says that teachers' slow adoption of

and adaptation to IT is rooted in complexity - differing perceptions of IT, problems associated with any type of change in schools and problems associated with professional concerns of teachers. Watson advises those charged with capacity building for teachers to work with teachers while designing and delivering staff development instead of ignoring their concerns, a caution that applies to developed as well as developing countries.

Watson's work highlights the importance of good research and evaluation studies as a means of guiding us towards future capacity building. Gail Marshall, USA, presents a summary of the kinds of resources - human resources, cultural traditions, models of evaluations, tests and measures, observation instruments and surveys - which have been used in pre-IT settings and which will help decision makers collect data as they analyze attempts at institutionalizing IT.

Resource acquisition, allocation and utilisation

The important role human resources - especially educational and professional bodies - can play in capacity building is carefully described by Peter Juliff. He presents specific suggestions about the programs and policies that those bodies have enacted in Australia, and the models can serve as guidelines for involving a broad range of professionals - from schools, universities, corporations and government agencies - in capacity building efforts.

Dudley Dolan, based in Ireland, addresses another instance of the way governmental bodies and other IT-expert professionals can work toward skill building for IT use. To ensure a uniform standard of competence for all IT users, the European computer driving licence has been established as a mechanism for assessing skill and for certifying performance with technology. Designed to change as IT competencies need to change, the European computer driving licence can serve as a standard for workplace capacity building in developed and developing countries.

Skill is also the focal point of James Isaacs's discussion of the importance of information literacy. Situated at a major Indian training centre, Isaacs draws a clear distinction between skills required for a world governed by the generation and use of materials, and a world governed by the generation and use of information. Education, he says, must change radically to equip citizens to meet the challenges of an information-driven world. Developing countries, where educational decision making is still fluid, have a special advantage and can succeed in 'leapfrogging' ahead of developed countries, where educational policies and practices have long-standing rituals and constraints, says Isaacs, who describes his work in helping IT users gather and analyze information worldwide.

Successful planning and procurement for Information Technology, says Ian Mitchell, results from a careful analysis of the local situation, and a straightforward specification of what is needed and why. Based on field experience acquired as a consultant from New Zealand to projects around the world, Mitchell provides ingredients for success - respect cultural sensitivities, work within the constraints of local conditions, keep projects small and consider all the ramifications of technology demands versus resources. His advice serves as a primer for consultants and for those seeking aid from funding agencies.

Adrie Visscher's work on Information Technology at the University of Twente, The Netherlands presents a primer of another sort. Visscher has skillfully analyzed the many demands placed on school administrators and staff. Visscher has developed a design strategy for maximizing data use and minimizing the redundancy associated with operations on school data. He stresses the importance of government's involvement in the adoption and institutionalization of such management systems.

Data at another level - statistics on a wide range of indices including per capita kilowatt hour consumption, the number of radios, TVs and computers per 1 000 inhabitants for developed and developing countries - are presented by Marsha Williams, USA, to show the disparity in resource dispersal between the 'have' and 'have not' countries. Collaboration and communication, conducted with respect on all sides, is essential, says Williams, in order to support equitable resource use and the universal quest for knowledge.

A curriculum for the future

Strategies for promoting knowledge acquisition are important features of the 'Creating Learning Networks for African Teachers' project, sponsored by UNESCO's Learning Without Frontiers initiative. David Berg and Jeannette Vogelaar's report on the project emphasises the ways current educational policies and practices must change in order to foster the lifelong learning - a requirement for survival in the Information Age. Berg and Vogelaar stress the complexity associated with IT-based change but suggest that many current constraints associated with schools' IT use may be overcome by encouraging communication and collaboration among teachers. Their descriptions of the pilot projects sponsored by UNESCO show the role that large-scale organizations such as UNESCO can play in capacity building.

Tom van Weert's presentation of the UNESCO/IFIP secondary school curriculum brings us full circle. Through his work at the School of Informatics, University of Nijmegen, The Netherlands and his leadership in IFIP, van Weert has contributed to the capacity building of colleagues around the world.

The UNESCO/IFIP curriculum is an important instance of the capacity building spirit. Bollerslev spoke of collaboration and the UNESCO/IFIP curriculum is tangible proof of the power that comes from a group of professionals pooling their talents. Ojo and Awuah discussed efforts at curriculum building and the UNESCO/IFIP curriculum provides a fundamental platform around which countries can organize instruction in IT topics.

Throughout the discussions of capacity building - whether from India or Norway or Namibia - we have seen both similarities in approaches to IT-based problem solving, and differences in conditions and solutions. By working on the similarities arrived at through diverse experiences, say van Weert, we will have a starting point for effective IT policy making. Again and again discussions have focused on fundamental issues and van Weert says attention must be paid to the fundamentals above all. Highlighting the need for qualified IT professionals, he reinforces the message of Kiangi, Modum and Dolan. As with Isaacs, Juliff and Watson, who see competence with IT as the sine qua non for personal and

professional growth, van Weert presents a curriculum that is a road map for today's and tomorrow's teachers.

The UNESCO/IFIP curriculum is developmental - a perspective endorsed by Cohen and Turcsányi-Szabó. It acknowledges that students at different ages need different types of experiences. But as students learn more about technology at earlier ages, the depth and breadth of their IT-based educational experiences must increase. The UNESCO/IFIP curriculum provides that flexibility.

In emphasising the dynamic nature of IT and reporting a curriculum with matching dynamic possibilities van Weert offers us a paradigm for all countries, whether developed or developing. Stable concepts must be the building blocks of capacity building; IT must be thoroughly integrated across a wide range of subjects; and collaboration is an essential strategy for planning and practice in our increasingly information-laden world.

Workshop presentations

Another aspect of capacity building is the demonstration of actual practice and the conference was fortunate to have several skilled practitioners present workshops where they modeled the kinds of day-to-day practices using IT that they had developed through their experience with IT.

Although many conference participants stressed the need to integrate IT across the curriculum, it was agreed that IT as a specialized subject still had a place in the education of all. Peter Hubwieser, Germany, presented a workshop, based on his work with Steffen Friedrich. The workshop emphasised three major aspects of informatics teaching: why should we teach informatics; what should we teach in informatics courses; and how should we teach informatics.

The workshop also stressed the idea that informatics as a subject should also enable students to use, control, and judge IT and its consequences. The workshop said that representations of information - real life situations that must be modeled - should be a focal point of instruction and presented ways to change, exchange and communicate data.

In her workshop on the use of hypermedia and the Internet, Karen Norwood, USA, stated the advantages of using hypermedia over traditional media - the appeal to different learning styles, the provision for students' creativity and the preparation of students for the 21st century, among other benefits. She then showed participants how use of the hypermedia and Internet can help students navigate through various domains of knowledge. The advantage of hypermedia and the Internet as tools for teaching mathematical topics that would be too difficult without technology's capacity for representation was also demonstrated in the workshop.

The work of a group of mathematicians working at the Instituto Matemetica Applicata, Genoa, Italy formed the basis of Guiliana Dettori's workshop on mathematical problem solving in IT settings. After defining IT and stressing the benefits of integrating IT into a subject such as mathematics, the workshop defined problem solving, elaborated the benefits of using IT in problem solving settings and demonstrated how IT can be used to foster mathematical problem solving. The workshop also presented several topics related to IT use for discussion and asked participants to compare national situations in order to share strategies for success.

Paul Nicholson, Australia, after critiquing the traditional Western models of research in IT, described action research and then led the workshop participants through a series of activities in scenario-based research. The plan of the workshop included asking participants to brainstorm where they are in the course of IT use and development, what can change in their own practice, and how they can plan for change. Provision was made for the participants to work alone, to share their situations with others, and to benefit from the advice and experiences of others.

Discussion Group recommendations

The Discussion Groups worked on a series of issues related to curriculum development, policy making and resource utilisation. Each Discussion Group had a formal meeting each day where the issues, constraints and prospects were discussed, and informal discussions also took place at lunch each day and in the coffee hours that forged bonds of collegiality among the delegates. The work of the Discussion Groups shows how devising strategies can be a powerful collaborative activity for capacity building.

Discussion Group 1 divided in to three sections. The curriculum and courseware development section reviewed the current situation in IT use in elementary education, and agreed on the importance of children's early access to IT. Specific examples of good IT practice with young children were offered - using computers to facilitate writing; CD-ROM use to facilitate listening; and problem solving software use to develop thinking, creativity and communication.

The importance of appropriate local conditions for IT use, access to electricity, equipment and human resources trained for IT use in early learning settings, were described. The need to establish goals for IT use was also seen as a critical factor in the successful use of school-based IT use.

Recommendations included integrating IT into all subjects; standardizing equipment to facilitate training; choosing software carefully; and collaborating with other countries to exchange ideas and resources.

Another section of the group discussed secondary education and used a framework provided by Paul Nicholson - curriculum, hardware, courseware and collegiality - to focus its discussion. In the field of curriculum differences in approaches - integrating technology across the curriculum versus teaching computer literacy as a separate subject - were noted. It was also noted that courseware and software development in Zimbabwe is usually locally-based with little funding available for those development activities.

The group then explored what in the situation can change. Recommendations for the future included a suggestion that greater efforts at courseware/software production be made locally. It was also suggested that hardware configurations need to be reanalysed to provide a uniform platform base in schools.

The third section of Group 1 based their discussions on the role of teachers in planning for change and highlighted the importance of teacher education in IT as a vehicle for change. Critical factors which can be changed in order to provide a suitable environment for IT adoption include: developing consortia for curriculum planning and infrastructure projects; and changing the culture of teaching from the delivery of imposed curricula to the development of reflective, flexible practices.

Discussing how change can be implemented, the group suggested that relevant national IT policies be identified and clarified; teachers be trained to implement the UNESCO/IFIP curriculum; minimum IT competencies for graduating teachers be mandated; and dissemination processes such as conferences, journals and newsletters be widely adopted and used.

Discussion Group 2 examined policies, strategies and initiatives for ICT in education, and identified four perspectives - social, pedagogical, vocational and catalytic - for defining IT-based educational objectives. That framework led to the specification of objectives - using IT as a tool for personal functioning or for catalysing and improving the quality of the learning process, for example.

The group said that in order to achieve those objectives policies are needed for IT access, for teacher training and for provisioning an infrastructure. Once policies are in place, strategies must be implemented to ensure success and those plans must be linked to national development programs. It was advised that research centers for assembling and manufacturing IT tools should be established, and networking all schools to public offices, other schools and to the Internet should be accomplished.

Discussion Group 3 examined guidelines and directions for ICT policy in education, and formulated a set of guidelines for policy making. Objectives outlined by the group include encouraging business and employment growth, and enhancing service delivery. In setting guidelines for IT implementation the group stressed the importance of continuing government support for IT, focusing on IT in the broadest educational sense and not limiting IT to training a few computer literacy skills. The importance of support, especially providing on-going professional development opportunities, was seen as essential for capacity building.

Discussion Group 4 worked on strategies for IT education and delivery. Focal points for strategising included: the difficulties involved in planning and investing in IT to ensure maximum efficiency and effectiveness; remedies to overcome perceived difficulties; and roles to be played by the IFIP community and others in creating successful IT use. The group's collective experience was that there are mixed levels of computer literacy among staff, varying degrees of success in integrating IT into the curriculum, and varying levels of official control of syllabi.

The group said IT must be integrated in all aspects of the curriculum but provision must also be made for specialised study of IT. Skill development of teachers was cited as critically important in achieving IT goals. Learning as an active, not passive, process was emphasised and pilot projects, showing teachers what IT can do, were judged to make an important difference in IT diffusion.

IFIP can act as a facilitator, said the group, through the sharing of expertise, the enabling of dialogue, the promotion of standards and the encouragement of government agencies in formulating innovative policies.

Discussion Group 5 examined the role of IT in managing educational administration. The case of Zimbabwe, where a need for better control of data was cited as a need, was a focal point of the discussion while the experiences of Hong Kong and The Netherlands were provided as illustrations of IT-based educational management in other countries. As a result, a series of issues related to Zimbabwe were highlighted. Among the issues discussed was the need for the development of a comprehensive information management system policy. The need to communicate that policy to stakeholders and the need for well thought-out plans for

design and implementation were also seen as important steps for Zimbabwe to take in managing data.

From those recommendations an action plan, calling for the participation of professional bodies, and the development of seminars designed to introduce and train people to use the systems, was devised.

Discussion Group 6 addressed the issue of building resource accessibility in developing countries. The group agreed that the first step must be clarifying the problem. Hardware and software needs should then be identified as well as human and infrastructure resources available for IT use. Accessibility and portability were identified as critical and inhibiting factors.

The group said every child in a developing country must have fun in 'hands on' IT experience and to achieve this goal the short-term objectives were identified, but the group also said comprehensive national policies must be developed. The group stressed the importance of providing computers for teachers. They also discussed ways donors might be sought, and emphasised the importance of government commitment to IT procurement and use.

Conclusion

All those attending the CapBIT conference knew that capacity building for IT in education in developing countries does not stop when the last speaker has spoken and the last delegate has left for home. Instead, all delegates shared the sobering realization that capacity building had just taken another step forward. But all participants of the conference were wiser in the knowledge of what their brothers and sisters around the globe had accomplished before arriving at the conference, richer in the knowledge of the plans, resources and possibilities available for IT-users, and more understanding of the potential for expanding IT use in their own countries and around the world.