Exploring the use of DITA learning content for generating training materials in international development

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Abstract
International organizations engaged in human capacity building for development generate many different types of technical documentation and training materials for a variety of audiences, often across different languages. The challenge for these organizations is to more easily reuse their content not only from one of their units to another, but also content components among different organizations. DITA provides the means to achieve this reuse for technical documentation, but also to reuse the technical documentation elements in learning content. This equally applies to the reuse of content materials of the United Nations University (UNU) and the Consultative Group on International Agricultural Research (CGIAR). In a joint effort, the UNU and the CGIAR are currently exploring the use of DITA to enhance the development and delivery of their training materials for national partners in Africa, Asia and Latin America. This presentation reflects about the initial experiences and challenges of adapting DITA to convert existing learning content as well as to incorporate content from other organizations such as the UNU into the learning resource base of the CGIAR.

Background
The knowledge generated by the research of the Consultative Group on International Agricultural Research (CGIAR) and the United Nations University (UNU) are made widely available as global public goods to individuals and organizations working for sustainable development throughout the world. Both the CGIAR and the UNU make available and accessible the resulting open educational resources (OERs) for human capacity building through information and communication technologies (ICTs) for consultation, use and adaptation by a community of users for non-commercial purposes, primarily in developing countries. The CGIAR, established in 1971, is a strategic partnership of over 60 members, which support 15 international agricultural research centers located in Africa, Asia, Latin America, the USA and Europe. The UNU, established in 1973, is an international community of scholars that generates and shares knowledge and strengthens capacities relevant to promoting human security and development, in particular in developing countries. It is comprised of a global network of 14 Research and Training Centres / Programs (RTC/Ps) in 13 UN Member States, coordinated by the UNU Centre in Tokyo.
Increasing the efficiency in learning content authoring
In order to improve the provision of open learning content to different target audiences, both the CGIAR and the UNU explore alternative means to develop and package their learning resources more efficiently and effectively. To disseminate this kind of content knowledge further requires structuring and taking advantage of the modularity of information in order to reuse components of scientific texts in technical documentation, but also in learning materials. A modular structure of this kind helps to increase the accessibility as well as the reusability of components of information, and promotes the seamless integration with modules of other information sets and collections.

Moving towards DITA
The reuse of content components is captured in the notion of single source publishing from the technical communication community, but equally applies to the creation of learning objects. In analogy with the document engineering approach, OERs resemble artifacts, which can be described with an XML document model and which are part of information exchange processes within and between organizations and their contextualization in specific domains; in the case of the CGIAR the teaching and learning processes in the agricultural sector of developing countries. The Darwin Information Typing Architecture (DITA) provides an XML schema to produce such modular content elements, including teaching and learning resources. Learning content developers would have access to open standards for structured information that can be adapted to produce OERs that can be easily reused and localized to meet the linguistic and cultural needs of specific user communities.

Overcoming content production silos
In the context of the or UNU he CGIAR Centers or UNU, content knowledge is usually generated by multiple research groups consisting of different scientists at one of the Centers / Institutes, together with researchers from partner organizations in developing countries. In general, these outputs can be grouped in four major communications categories, that is, (1) scientific or scholarly communication (e.g., research articles, book chapters, conference materials, research briefs), (2) technical communication (e.g., technical manuals, technical guides), (3) educational communication (e.g., training guides, workshop materials, lecture notes), and (4) corporate communication (e.g., annual reports, newsletters, brochures).
**Embracing single source publishing**

In most cases, the individual CGIAR Center or UNU Institute serves as the publisher or copyright holder while the actual publications (and translations) are financed by the research team from restricted research funds. This situation leads to the problem that individual authors produce singular publications over time, often repeating entire topics that have already been published elsewhere by the same organization. At the same time the organization usually lacks additional core funding to maintain these publications, including updates and translations. Rather, international organizations such as the CGIAR or the UNU should embrace single source publishing in order to more effectively produce modular content that can be more easily reused and maintained.

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**Increasing learning content reuse**

By applying the DITA learning specialization topic, coupled with a topic-based, modular approach to the planning, development and delivery of content, the CGIAR and UNU intend to increase the reuse of its learning content in a joint project. DITA will help to enhance the use of learning content in the following scenarios:

- The CGIAR maintains an agricultural learning repository, which enables the indexing, searching, and retrieval of learning content based on IEEE learning object metadata (CG LOM Core), including federated searches through the [Global Learning Objects Brokered Exchange](http://www.globelx.org) (GLOBE).

- Integrated with the repository, the CGIAR maintains a SCORM-compliant learning management system (LMS), into which course authors can directly import learning objects from the repository to create custom courses quickly (e.g., existing learning resources are modified to online learning modules).
The CGIAR makes its research and technical content available for direct sharing and reuse in learning and training by its Centers and national partners, but also across other organizations such as the UNU (e.g., information objects on the topic of disaster risk reduction from the UNU are integrated into agricultural training modules of the CGIAR).

Enhancing the instructional design of DITA learning content

In its joint project, the CGIAR and UNU are applying van Merriënboer’s Four-Component Instructional Design (4C/ID) model to create technical training for agricultural scientists in Sub-Saharan Africa. The model focuses on improving performance-related problems through training by teaching the complex skills, professional competencies, and attitudes involved in a domain in one interconnected knowledge base. Through its focus on authentic learning tasks based on real-life situations coupled with supplemental information, the 4C/ID model is particularly well suited for vocational and professional education programs, job-oriented university programs, and competency-based training programs.

Mapping 4C/ID to DITA

The detailed training blueprints resulting from the 4C/ID process consist of four interrelated components, that is:

1. **Learning task:** Authentic whole-task experiences based on real-life tasks that aim at integrating the constituent skills (non-recurrent and

Mapping of the 4C/ID model to the DITA learning specialization.
recurrent) with associated knowledge and attitudes (e.g., case study, project, problem, etc.). They are organized in easy-to-difficult task classes with decreasing scaffolding through solution-process guidance and task support as learners acquire more expertise. A sequence of learning tasks provides the backbone of a training program for complex learning.

**2. Supportive information:** Information that is helpful for learning and performing the non-routine problem-solving and reasoning aspects of constituent skills classified as non-recurrent. Supportive information explains how a particular domain is organized and how problems in that domain can be approached (concepts, facts, principles, process).

**3. Procedural information:** Information that is prerequisite for learning and performing routine aspects of constituent skills classified as recurrent, usually presented just-in-time (procedure).

**4. Part-task practice:** Additional practice items that are provided to teach the routine aspects of a (job) task.

The **4C/ID model** supports the notion of reusable learning objects. The training blueprints for an educational program aimed at complex learning can be expressed in IMS Learning Design, but can also be captured using DITA. The blueprints are then ready for developing a learning environment and producing instructional materials.

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**Task class 1:**

Learners visit a well-equipped and maintained tree nursery, including a composting area. The nursery contains seedlings of an agroforestry tree species ready for prickling out, and polybags and root trainers.

**Supportive information:**

Learners listen to an expert talking about nursery management practices and procedures.

**Supportive information:**

- Conceptual model of quality seedlings
- Structural model of a root trainer
- Conceptual model of different potting mixtures

**Task class 1.1: Case study**

Learners receive three different samples of planting seedlings in different potting mixtures. The learners have to study the samples, and explain the effects of different soils on seedlings.

**Task class 1.2: Case study**

Learners are shown five different containers, displaying the root system. They must open the containers and inspect the root system, make drawings of the roots, and discuss possible reasons for their growth form. They are asked to discuss how root deformities can be avoided.

**Task class 1.3: Completion**

Learners receive a task to prick out seedlings. They have to perform this task considering the role of potting mixtures.

**Procedural information**

Procedures for prickling out seedlings
Output examples

To illustrate the points made earlier, we have selected a topic from existing training materials on vegetative tree propagation in agroforestry, that is, managing tree nurseries. The sample text has been processed with Adobe® FrameMaker® 9.

Seedling quality

A high-quality seedling meets a buyer's expectations or standards of performance on the planting site. Although quality is mainly judged in terms of physiological quality, genetic quality also applies. It is important for nursery operators to ensure that their seedlings have both aspects of quality, and that farmers are adequately informed on these quality aspects.

Phenotypical quality is the physical appearance of a seedling and the aspects that enable its ability to establish quickly when planted in the field. Poor phenotypical quality can be easily observed at the nursery level or seen after field establishment.

Genetic quality is the combination of different traits from the parents of the plant, which ensure that it can establish in a given area, continue producing high-quality products in the future, and that the offspring will also show the same genetic quality after a long time. The consequence of poor genetic quality in the widespread future effects, such as maladaptation and inferior products from trees on many farms.

Quality seedling:
- Have a well-developed root system.
- Are able to produce new roots quickly.
- Are tolerant to adverse growing conditions.
- Have a well-developed shoot tissue.
- Have good carbohydrate reserves, and

Pricking out seedlings

Requirements:
- Sharp stick or dibbler
- Sufficient seedlings of an agroforestry tree species ready for pricking out

Steps:
1. Carefully wet the soil of the seedling box or seedling bed to allow easy removal of the plants.
2. Lift the seedlings with a knife or a flat piece of wood. Select only healthy, strong seedlings.
3. If roots are too long, prune them with a sharp knife.
4. Place the seedlings into a flat rosetted with water and cover with a moist cloth or paper.
5. Using a sharp stick or a dibbler, prepare a hole in the container that is big enough to accommodate the roots without bending them.
6. Carefully insert the seedling into the hole and lift slightly to allow the roots to straighten.
7. Close the hole by pressing the soil gently against the roots, so that the seedling sits firmly in the container.
8. Water and put the containers in a shaded area.
Learning task incorporated into the content body as a \texttt{lcChallenge}.

\textbf{Related topics}

- Seedling quality
- Pricking out

\textbf{Summary}

Good nursery management and organization requires proper planning. The most important aspects being timing and the estimation of nursery substrate and plants needed to produce the required number of trees. Nursery managers should interact more with their customers to improve their management skills and the quality of the planting material they supply.

DITA map incorporating DITA topics (concept, task) as well as DITA learning content.
Outlook

The goal of the joint R&D project of the CGIAR and UNU is to develop reusable learning objects for technical training of agricultural scientists in Sub-Saharan Africa. Instead of working from scratch, the team is currently identifying and selecting topics from existing training programs in collaboration with national partners. The team is in the process of applying DITA learning specialization to the legacy materials and modify them accordingly following the 4C/ID model. The project intends to generate courses and corresponding instructional materials based on these resources, adjusted to the needs of the national partners. The materials will be prepared in such a way that they can be easily used in instructor-led face-to-face instruction (e.g., printed training manuals, instructor guides), but also on-line using a SCORM-compliant LMS (blended learning). The learning objects will also be shared in the agricultural learning repository of the CGIAR (learning.cgiar.org). The team intends to demonstrate how DITA learning specialization can be used effectively and efficiently in producing training in the context of international development. We hope to showcase how DITA can be applied for single sourcing, repurposing and reuse of technical content from the research of the CGIAR and the UNU to make it available and accessible for direct sharing and reuse in learning and training of these international organizations and their national partners in developing countries.