Introduction

Nous vous accueillons comme un formateur pour développer un cours de perfectionnement professionnel pour enseignants; à base de matériaux produits dans le projet LEMA.

Un aspect intéressant du projet est qu'il a été développé dans six pays européens et qu'il a été financé par l'Union Européenne. Cela devra permettre aux professeurs, au-delà des six pays, pour travailler sur des tâches qui ont une dimension européenne de sorte que les élèves peuvent apprendre davantage sur leurs pairs dans les autres pays.

Le site du projet www.lema-project.org permettra aux professeurs d'apprendre davantage sur l'enseignement des mathématiques et éventuellement de communiquer avec des collègues d'autres pays à propos de leurs expériences dans l'utilisation de la modélisation.

Les matériaux sont modulaires de façon à ce que vous puissiez composer un cours approprié à votre pays autour des quatre modules principaux suivants :
Modélisation
Tâches
Leçons
Évaluation
Chacun de ces modules est encore divisé en deux ou plusieurs sous-modules, comme indiqué dans le tableau suivant .

Le module additionnel "Réflexion"

In addition there is an additional module “Reflecting” that will allow you to deal with any problems or negative feelings about modelling that may emerge. This particular module recognises the difficulty of changing classroom practice when teachers have well established patterns of working and are also under many pressures whilst being accountable to their pupils, parents and managers within their school. We understand that making changes are often difficult and this particular module allows you to attempt to respond to any concerns as they develop.

En outre, il existe un module supplémentaire "réfléchir" qui vous permettra de faire face à des problèmes ou des sentiments négatifs au sujet de modélisation. Ce module particulier reconnaît la difficulté de changer la pratique en classe lorsque les

enseignants ont schémas bien établis et sont également, tout en étant responsables devant leurs élèves, sous de nombreuses pressions des parents et des gestionnaires au sein de leur école. Nous comprenons que les changements de décisions sont souvent difficiles et que ce module vous permet notamment de tenter de répondre aux préoccupations émergentes.

For each module there is:

- a rationale – an introduction for you with some ideas of further reading
- an introduction for teachers.

These are brief documents that introduce the ideas underpinning the module. The trainer's "rationale" gives more detail than the introduction for teachers setting the module within the appropriate theoretical background and hopefully giving you some pointers to further reading and research that will help you develop a rich background in the module's particular aspect of modelling.

For each sub-module there are the following materials for you to work with:

- a trainer guide,
- a powerpoint presentation
- resource materials for the teacher
- pages for a reflective diary which teachers can use to record their experiences and reflect upon their professional development during the course.

We suggest that you provide each teacher with a ring binder at the outset which they can use to work with as the course proceeds, collecting documents that will arise from the activities in which they will take part as well as the reflective diary pages.

As you will soon discover this is an interactive course during which teachers will work with each other to explore their current teaching of mathematics, and how this can be developed and enhanced by adopting a modelling approach.

Working with the trainer guides

The trainer guides set out details of how you might run each sub-module with teachers. It gives details of all the resources you will need and "walks" you through a possible way of running the sessions making very clear links and references to the appropriate powerpoint file. However, although the trainer guides are quite prescriptive we encourage you to respond to local needs as they arise and adapt the course to the needs of participants. Throughout all modules the intention is that teachers will be very much interactively involved in all aspects.

We strongly recommend that you read the trainer guides well in advance of the course so that you can decide exactly how to adapt your course to your knowledge of local and national contexts.

Working with the powerpoint slides

Each sub-module has a powerpoint file setting out a structure for a number of sessions (often 1 session, but on occasions 2 or even 3 sessions). When there is more than 1 session the sub-module has often been designed so that if at all possible teachers can work on aspects of the sub-module with their students between sessions with the outcomes informing the later session. We recognise that this will not always be possible and therefore provide alternative approaches and paths through the course.

We hope you will use the powerpoint files to provide a structure and starting point for your course but do encourage you to be both proactive and reactive to respond to the particular context in which you are working.

Working with the resources

Each sub-module will require a range of resources: written materials in this category are provided, for example introducing tasks for participants to work with and possibly video sequences to allow teachers to observe teachers and students involved with modelling in their classrooms.
Throughout all sessions you will find it advantageous to have available stationery materials such as flip-charts, poster paper and pens, card, scissors, glue, squared paper and so on.
You may find it useful to have a camera so you can record the work that participants produce: this can prove very helpful in sharing posters with the whole group that sub-groups will produce.

Working with the teacher diaries

An important aspect of the design of the course has been to incorporate a reflective diary for teachers. This will allow them to reflect as they proceed through the course on the issues that will emerge. Often the reflective diary will allow space for teachers to consider and plan how they might incorporate modelling into their lessons; in such cases they are encouraged to write briefly about their resulting experiences and those of their students.

You may consider how you might encourage participants to share their reflections and thoughts on occasions. For example, if teachers have planned and used a particular approach suggested in a sub-module you might ask if anyone is willing to share their experiences and reflections at the start of a subsequent session.

To encourage participants to work with the reflective journal the end of each powerpoint file makes reference to it suggesting what participants will be asked to consider in the appropriate pages.

Designing the course

The course materials have been designed with the intention that they will require five days to work through them. However, flexibility has been designed into these materials so that you can develop your own approach to best cater for teachers in your national context.

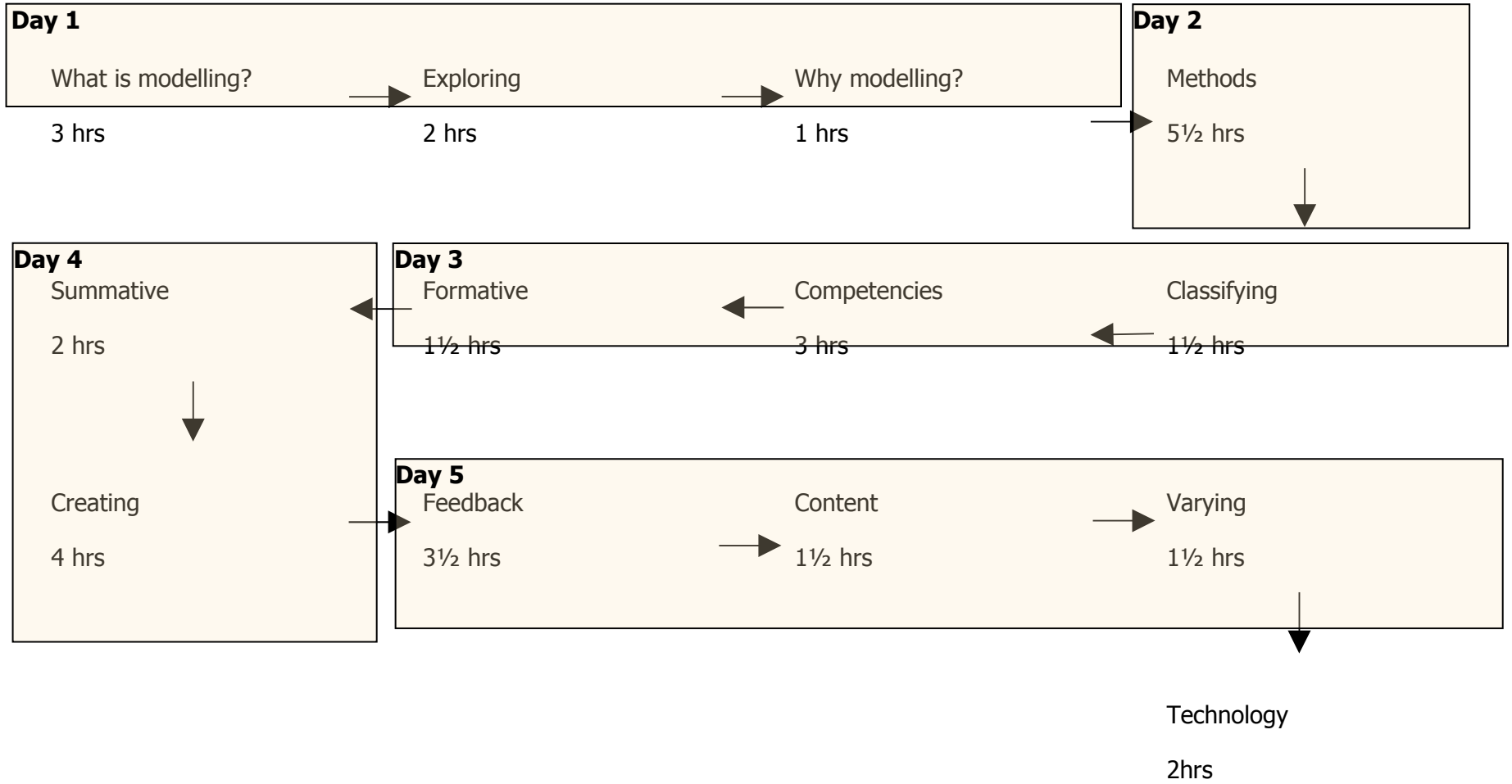
The following table shows the titles of the sub-modules within each module: a brief description of each is given in the "Module Outlines" which follow towards the end of this introduction.

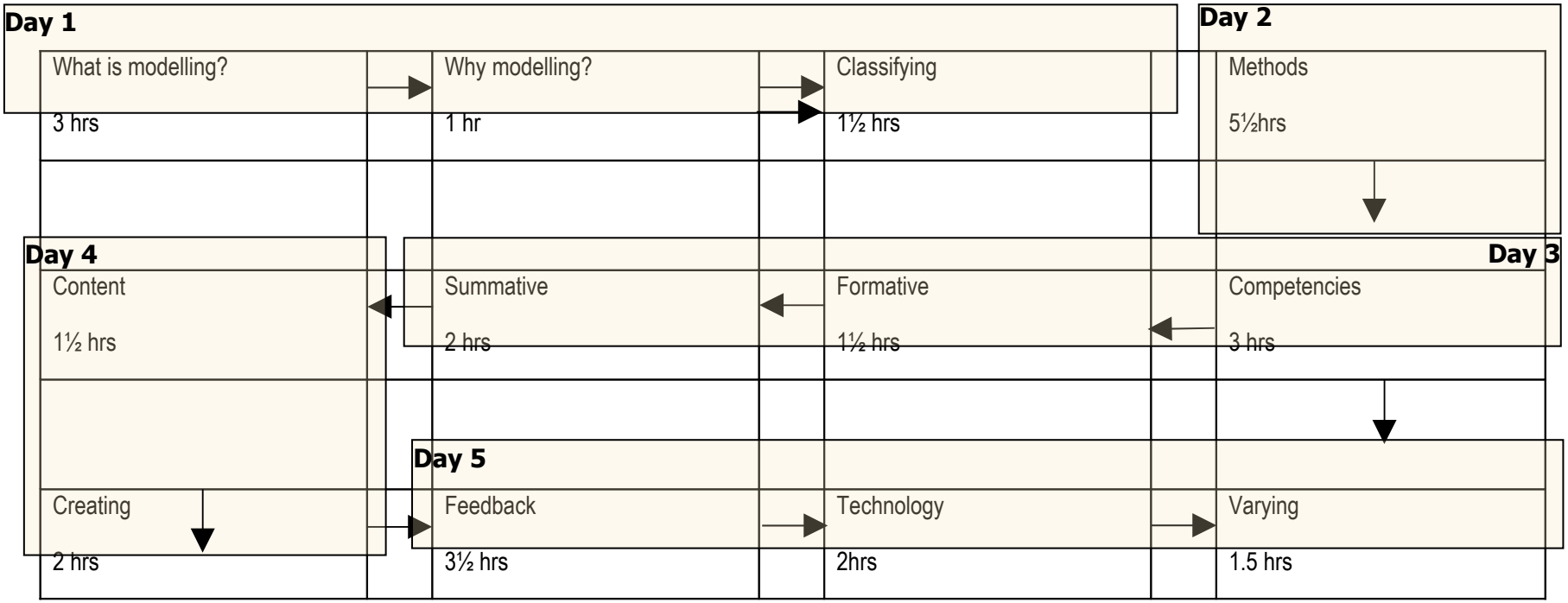
Modelling	***Tasks***	***Lessons***	***Assessment***
What is modelling? 2 + 1 hrs	Exploring 2 hrs	Methods 2½ + 1½ + 1½ hrs	Formative 1½ hrs
Why modelling 1 hrs	Creating 1 + 1 + 2 hrs	Competencies 1½ + 1½ hrs	Summative 2hrs
	Classifying 1½ hrs	Content 1½ hrs	Feedback 2 + 1½ hrs
	Varying 1½ hrs	Using technology 2hrs	
Reflecting	Implementation 1hr	Challenges 1hr	

Although the design of the course allows you flexibility in the order in which you use the sub-modules it is suggested that you start with the sub-module ***What is modelling?*** and that you use the sub-module ***Why modelling?*** during the early part of the course. On the other hand, other sub-modules may be omitted due to time being limited (this may particularly be the case if participants become involved in lively debate in some modules) or because they have relatively low priority in the national context in which you are working (for example, your teachers may have limited access to technology). Although the first sub-module of a module may need to be used first, this is not always the case (for example, in the module ***Tasks*** the first sub-module, ***Exploring*** is optional as in the main it allows participants a further opportunity beyond that of the sub-module ***What is modelling?*** to engage with a substantial modelling task. It may be that you think your particular course participants do not need such an opportunity. However, in the ***Assessement*** module the first sub-module, ***Formative***, does need to be used first in the sequence. A further restriction is that the sub-module ***competencies*** is used before starting to work on the ***Assessment*** module.

On the following page two possible routes through the materials is organised with five days indicated.

Please note that these are just two possible routes, and it may be that you wish to devise your own tailor-made course.


Day 1
What is modelling?
3 hrs
Exploring
2 hrs
Why modelling?
1 hrs
Day 2
Methods
5½ hrs
Day 3
Formative
1½ hrs
Competencies
3 hrs
Classifying
1½ hrs
Day 4
Summative
2 hrs
Creating
4 hrs
Day 5
Feedback
3½ hrs
Content
1½ hrs
Varying
1½ hrs
Technology
2hrs


Day 1
What is modelling?
3 hrs
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1 hr
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1½ hrs
Day 2
Methods
5½hrs
Day 3
Competencies
3 hrs
Formative
1½ hrs
Summative
2 hrs
Day 4
Content
1½ hrs
Day 5
Creating
2 hrs
Feedback
3½ hrs
Technology
2hrs
Varying
1.5 hrs

Module outlines

Modelling

What is modelling?
(2 + 1 hrs)
This introductory sub-module includes a first session which allows participants an opportunity to work on modelling and application tasks for themselves. This will provide an initial opportunity to consider the nature of mathematical modelling which they will refine in a second session. This prompts careful consideration of the modelling cycle and also uses the PISA framework description of this to summarise the process.

Why modelling?
(1 hrs)
Teachers will recognise that there are arguments both for and against using mathematical modelling in their teaching. This sub-module encourages them to explore these, with the intention of ensuring that they emerge not only convinced of the value of using a modelling approach as part of learning mathematics, but also well informed about likely obstacles and how these might be overcome.

Tasks

Exploring
(2 hrs)
This optional sub-module allows participants a further opportunity to work on a modelling task in detail themselves. This is a very good way to really get to understand some of the complexities of modelling which is essential if participants are to be able to work effectively on other sub-modules. There is also a first chance to consider how the design of tasks can affect what happens in the classroom – understanding of which will be useful when participants come to develop their own tasks in later sub-modules.

Creating
(1 + 1+ 2 hrs)
This sub-module encourages participants to work creatively to develop some tasks for use with their own students. It is important to consider how this can be done as tasks that are focused on the backgrounds, interests and needs of students can prove most motivating. In a first session this sub-module suggests that participants can develop suitable tasks from a range of different situations by adopting a "modelling view" of the world; a second session suggests that there are also opportunities to consider how tasks can be developed from contexts suggested by existing (traditional) texts, whilst finally a workshop is provided in which participants can work together to develop some tasks.

Classifying
(1½ hrs)
This sub-module suggests that it is important to consider different ways in which tasks can be classified as this provides ways of thinking about how tasks can be adapted or varied in the most suitable way for use by teachers with their own classes. The next sub-module allows participants to consider this adaptation / variation of tasks.

Varying
(1½ hrs)
This sub-module encourages participants to consider how they might vary existing tasks to make them more suitable for use in their classrooms with their students. In recognition that at times teachers will have specific objectives related to the learning / development of specific competencies it considers how tasks might be varied to account for this.

Lessons

Methods
(2½ + 1½ hrs + 1½ hrs)
It is likely that the introduction of modelling into mathematics lessons will require teachers to change their classroom practice. Consequently consideration of appropriate methods is essential. In the three sessions of this sub-module participants will have an opportunity to consider a range of useful methods. Central to modelling activity is the use of group work and organising lessons in such a way that students have opportunities to work effectively in groups with support from their teacher in the different stages of the modelling cycle: this is considered in the first of the three sessions of this sub-module.

The second session allows opportunities for participants to consider how to deal with problems that might occur in a number of areas. Finally the third session gives prominence to the use of argument and discussion in mathematical modelling lessons and suggests that we should encourage students to engage in mathematically informed discussions.

Competencies
(1½ hrs + 1½ hrs)
Students need to consider developing competencies at different levels: they need to develop sub-competencies such as those involved in setting up models and interpreting and validating the solutions to problems suggested by their mathematical models. In addition to considering how this might be encouraged a first session also looks at developing skills in reasoning and arguing using mathematical modelling. The second session allows participants an opportunity to consider how students might develop meta-cognitive understanding of the modelling cycle to assist them with their modelling.

Content
(1½ hrs)
In recognition of the fact that many teachers are under pressure to focus lessons so that students learn new content this sub-module explores ways in which they might develop a modelling approach to the teaching and learning of mathematical content.

Using technology
(2hrs)
Technology can be used most effectively to support students working mathematically on their models. In particular generic software such as dynamic geometry packages, graph plotters and spreadsheets, can be used on a wide range of problems. This sub-module encourages participants to explore this by presenting some tasks which can be solved with such an approach. Ideally, participants should have the opportunity to work with technology themselves on a problem or two during the sub-module.

Assessment

Formative
(1½ hrs)
Central to the philosophy underpinning the sub-modules about assessment is the belief that formative assessment should underpin all teaching and learning. This sub-module, therefore, introduces important ideas about how teachers can work with learners to attempt to get them to understand how they can become more involved in developing their own learning. It focuses on how teachers can share and use learning objectives with their students to encourage this, develop their questioning skills, consider how to give feedback that moves learners on, use summative assessment in a formative sense and eventually encourage students to assess the work of each other and themselves.

Summative
(2hrs)
Summative assessment that allows teachers to summarise the progress of their students and report this to others is always an important concern. This sub-module, therefore, develops assessment and marking strategies that build on the understanding of competencies and the modelling cycle that will have been met in previous sub-modules. By the end of the module teachers should have a means of formally assessing and reporting on students' achievement and progress.

Feedback
(2 + 1½ hrs)
This sub-module builds on the ideas that have been developed in the ***Assessment: Summative*** sub-module and sub-modules concerning competencies in modelling by considering how teachers can give effective feedback to students as they work on modelling tasks. A first session introduces the ideas whilst a second session allows reflection on how this works in practice (in some cases teachers may have been able to work on the ideas between days of the course). Additionally it moves on to consider how pupils might be involved in assessing their own work.

Reflecting

This module provides two brief sessions that you may or may not wish to incorporate into your course. They allow participants to reflect upon and examine different aspects of the challenges that changing teaching practice pose.

Implementation
(1 hr)
This brief sub-module encourages participants who have had an opportunity of working with students between sessions of the course to reflect on their experiences and share these with colleagues. This offers an opportunity for teachers to consider problems they may have encountered and working with colleagues they may see ways of overcoming these.

Challenges
(1 hr)
Teachers may meet challenges to their attempts to introduce mathematical modelling into their lessons. These may arise from students, parents or the school organisation in general. This is not necessarily because of mathematical modelling in particular, but perhaps because of the very fact that it is a variation from customary practice. This sub-module allows participants to consider with colleagues the challenges that this may pose, and hopefully develop strategies that will allow their use of mathematical modelling to be successful.