e-Learning Cookbook

TPACK in Professional Development in Higher Education

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Contents

Preface **5**

Introduction **7**

Part One **9**

Recipes for implementing TPACK **9**

1. Integration into the Organizational Context 11
2. Social Bonding 19
3. Degree of 'Blendedness' 25
4. Content & Assignments 33
5. Learning Process & Moderation 41
6. Tools & Technology 51
7. Planning & Timing the Module 57
8. Participants & Recruitment 63
9. Goals & Expectations 71
10. Policy 79

Part Two **85**

Dimensions of implementing TPACK course redesign modules, Data Collection **85**

1. Introduction 86
2. Dimensions of Implementation 89

Part Three **93**

TPACK course redesign professional development modules **93**

1. Introduction 94

1.1 The paradigm shift 96

1.2 Anchoring learning in one's own teaching practice 97

1.3 'Teach as you preach' principle 98

2. Theoretical Foundations 99

2.1 Social constructivism 99

2.2 The DA model 100

2.3 Bloom's Taxonomy 101

2.4 Constructive Alignment 103

2.5 Action research 105

3. Pedagogical Analysis 106

3.1. Conceptual analysis of the subject 106

3.2 Learning outcomes 114

3.3 Instructional design 117

4. The Effect of Professional Development 121

References **125**

Preface

Information and communication technology (ICT) makes it possible to bring information to everyone who wants to learn. Rapid advances in technology offer strong support for using ICT in teaching. Online education can intensify and improve students' learning process, and enables us to reach more students than by traditional means. The number of courses and modules being offered online is increasing rapidly worldwide. This is happening not only at traditional institutions for distance education, but even more so in the 'classical' institutions for higher education. Such decisions are motivated by the improved technology available for web lectures, combined with financial motivations, i.e. being able to offer courses to larger groups of students. There is a huge trend toward open massive online courses or MOOCs. Prestigious universities offer MOOCs free of charge to a mass audience, often up to hundreds of thousands of learners.

Although online education can reach more people nowadays and new and challenging learning experiences can be created with it, in the average university course the digital dimension too often remains limited to simply publishing the existing face-to-face course content online. Educational technology is often seen as an 'extra,' a luxury tool, and not as an integral and indispensable element of a university's teaching design. It is thus crucial that lecturers have and can obtain knowledge about how to design technology-enhanced teaching. Technical advances can be expected to continue in the future, and those who wish to implement educational technology in their own teaching practice must reckon on becoming lifelong learners. This fits the culture of academic teachers perfectly: they are already lifelong learners and creators of new knowledge within their discipline.

This book is based on the notion that a lecturer who uses ICT in teaching must learn how to apply his or her knowledge about content, pedagogy and technology in an integrated manner. The idea of integrating these three types of knowledge is based on the TPACK model, which stands for Technological Pedagogical Content Knowledge model (Mishra & Koehler, 2006).

The material for this book was developed in a Dutch higher education innovation project known as MARCH^{ET} (**MA**ke Relevant **CH**oices in **e**ducational **t**echnology, MARCH^{ET}, 2009-2011). This project provided four practice-oriented TPACK course redesign modules for the professional development of university lecturers. The modules all had the same structure and the same instructional design. For two years during the project, the modules were organized by five collaborating Dutch institutions of higher education. The modules were online, using a virtual learning platform based on SharePoint, which was enriched by a virtual meeting space in Adobe Connect. After the project was finished, the modules were further organized at local level by each of the five Dutch institutions using their own institutional virtual learning platforms. This book is based on the lessons they learned organizing professional development modules and implementing TPACK. It is meant to help others who would like to introduce university lecturers to TPACK. We have chosen to present this book in the form of a cookbook. Cookbooks give clear, step-by-step instructions – a recipe – for creating something. They also produce an immediate result if you follow the recipe, because they provide useful guidelines, tips on how to succeed, and pitfalls to avoid. But a good cookbook should also inspire you to use your creativity to adapt recipes to your own situation, and to invent new recipes that suit your taste perfectly.

We would like to thank SURF, the organization that supports ICT in higher education in the Netherlands, and the five universities that made it possible to undertake the MARCH^{ET} project and to write this book: the University of Amsterdam, Amsterdam University of Applied Sciences, Maastricht University, UMC Utrecht and Utrecht University, and Eindhoven University of Technology.

We hope this book will help institutions and trainers organize professional development programs for university lecturers so that they can apply TPACK in their teaching practice.

Have fun making delicious TPACK redesign ‘cakes’!

Natasa Brouwer, Peter J. Dekker and Jakko van der Pol
Amsterdam, April 2013

Introduction

Many universities organize workshops or even a whole professional development program in which lecturers are taught how to teach and how to organize their teaching. Today, every university uses ICT in one way or another. Using educational technology is more complex than simply adding an ICT tool to a course. It should change the way we teach and also what we teach. Switching from face-to-face to blended or online teaching and learning is therefore not a self-evident enrichment. It requires teachers to adapt or even to change their course design completely. The question is: How can a lecturer acquire the knowledge necessary to design quality technology-enhanced teaching? There is no simple answer to this question. Knowing how to operate the ICT tools is not enough. Different kinds of knowledge need to be integrated to create successful technology-enhanced learning activities.

A second important question is: What is an appropriate course design for teaching lecturers how to design technology-enhanced teaching? Do we have to change the approaches to learning when the learners are themselves teachers in their daily lives?

In confronting these challenges, the Dutch project MARCH^{ET} (**MA**ke **R**elevant **CH**oices in **e**ducational **t**echnology, 2009-2011) developed four professional development modules to help university lecturers obtain the knowledge and skills they need to design their teaching using educational technology:

- 'Collaborative knowledge-building'
- 'Web 2.0 educational applications'
- 'Measuring knowledge and understanding'
- 'Supervising students in distance learning'

The packages of materials for the four modules developed in the MARCH^{ET} project, including study guides and assignments, were written in English and are available to download free of charge at www.onderwijsontwerpenmetict.nl (Dutch website, click on 'Modules' in the bar at the top of the page).

The modules teach lecturers how to use TPACK when designing their teaching. They have been designed according to the TPACK principle.

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TPACK, which stands for Technological Pedagogical Content Knowledge model, was developed by Mishra & Koehler (2006) and brought about a revolution in our understanding of the quality of teaching using technology and the role of the teacher in it. Technology-enhanced course design using TPACK is like creative cooking: you need high-quality ingredients, a good basic recipe and a lot of creativity. A good TPACK course design, one that fits the lecturer's teaching style, the subject matter and the group of students, will result in a unique learning experience every time.

It is important to mention here that the universities that organized the modules and used the MARCH^{ET} TPACK material adjusted the material in some way to fit into their situation. In this book we describe what these universities have taken into account to reach an optimal situation. Based on their experiences, we defined ten dimensions that influence the decisions that must be made when organizing professional development modules for lecturers. This provided the basis for developing ten recipes, one for each dimension. The recipes are accompanied by helpful tips from 'our tasters' – people who have organized or moderated actual modules.

This book consists of three parts. They are closely related to one another, but they can be read in the order that the reader likes best. In Part One you will find the ten recipes with helpful tips from our 'tasters' on how to implement a professional development module within an educational institution. In Part Two we explain why we chose these ten recipes and not others. In Part Three we discuss the theoretical backgrounds and the structure of the TPACK professional development modules for course (re)design. We also list the competences needed to be able to design technology-enhanced teaching and learning in higher education.

Part One

Recipes for implementing TPACK

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1. Integration into the Organizational Context

If you want lecturers to study a professional development module on using ICT in teaching (such as the MARCH^{ET} modules, see Part Three) or even a series of modules, you need to think about the level at which to organize it. For example, the module can be organized only for lecturers working within a single faculty, for lecturers working within a single institution for higher education, or more broadly, up to the national or even the international level. Each situation has its own advantages and disadvantages.

The advantage of organizing modules on an inter-institutional level (national or international) is that it becomes possible for lecturers who teach the same subject at different universities to share what they have learned. The lecturers who teach the same discipline 'speak the same language'. Experiences with and approaches to solving students' learning problems will be very recognizable to them, and they will be able to share teaching materials – though every institution for higher education has its own educational approach, of course. In general, a nationally organized module will be an important enrichment for the lecturers who attend it. On the other hand, if the professional development module is more integrated into the organizational context, it will be more successful for the organization as a whole.

If you organize the professional development module on course design at the local level, the lecturers can share thoughts about their teaching designs more naturally, since they will meet spontaneously at the coffee machine or during lunch. A module organized locally allows the institution to adapt the pedagogical learning outcomes and technological knowledge expectations to the institution's pedagogical vision and the available technological infrastructure. For instance, the electronic learning environment that is chosen for the module itself can be the same as the learning environment used for students. The module moderator can

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'teach by example.' A more local approach to organizing can therefore lead to the technological, pedagogical and content knowledge (TPACK) most closely attuned to the participants' educational practice.

Each discipline has to deal with its own difficulties in learning and teaching and faces its own challenges. The core disciplinary concepts need to be constructed and refined by engaging in the practice of scientific inquiry. While the natural sciences operate in a universe of data evidence and equations, the social sciences tend to operate in a world of perspectives and opinions. These things will influence the choices that must be made in the course design. When the professional development module is even more locally organized, for example within a specific department, it becomes even more possible to adapt the content of the module to the specific subject that the participants are teaching. Using discipline-specific examples and more content-specific assignments will motivate the participating lecturers to learn about pedagogy. It will also help them integrate their technological, pedagogical and content knowledge into their courses more efficiently. A locally organized module can rely on existing social structures and can create more commitment and 'momentum,' which in turn can strengthen the social structure. The efforts and the achievements of the participating lecturers will also be more visible to the management.

Recipe for 'Integration into the Organizational Context'

Ingredients:

- ***Adapted content***
- ***Adapted vision***
- ***Adapted technical infrastructure***
- ***Integrated internal training programs***
- ***Involved management***

Adapt the module to the context of the organizational level

The professional development module needs to fit the organizational level. If you use an existing professional development module developed for mixed inter-university groups at a different organizational level – such as a university, faculty, or department – you need to adapt the module to the context of the new organizational level. The better a module fits the participants' teaching context, the more effective the module will be.

Adapt the content of the module to the institution's educational vision

It is important to adapt the module to the institution's educational vision. If an institution bases its teaching on one strong vision – such as problem-based learning or competence-based learning – the course design that participants will create and the teaching materials they will develop during the professional development module need to be consistent with this vision in order to be useful. By adapting the module to the institution's educational vision, the participants will gain a better understanding of this vision and will adopt it more easily in their own teaching.

Adapt the content of the module to the available technical infrastructure

The module content should also to be adapted to the available technical infrastructure. If the module makes use of tools or software licenses that are unavailable to the participants, they will need to redesign their products/plans/outcomes in order to apply them in their own course. This will take extra

time and extra technical effort. If you do not adapt the content of the module to the available technical infrastructure, you run the risk that the tools developed in the module will never be used in practice.

- *Involve the management*

The synergy created by approaching issues through multiple platforms at the same time can be very powerful. Making the curriculum coordinators or program managers aware of the professional development module – or even involving them in it – will increase the extent to which the knowledge gained in the module is applied in teaching practice. It can be very effective to apply the module in an existing curriculum development or revision process. In addition to commitment and motivation, the module will also be more effective if it addresses questions, issues or problems that are already 'on the radar' of the lecturers' team or the management. The management can raise relevant teaching problems that the module should address.

- *Make the module an integral part of internal professional development training programs and policy*

Many institutions organize professional development training. In the Netherlands, for example, university lecturers are obliged to obtain a national teaching certificate. This requires them to show evidence of their competencies. Attending professional development modules designed according to the MARCH^{ET} approach allows participants to produce sound evidence of their teaching design skills, which can then be used to acquire a certificate. It is advisable to integrate the module into the existing certificate training program, so that the pedagogical and personal coaching structure will suit the specific expertise available in the field of educational technology.

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Advice from our tasters: helpful hints

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The module content was fully adapted to the demands of Maastricht University's educational vision, especially our 'problem-based' approach to learning. The module only made use of ICT tools then available at the university.

One important wish on the part of the participants was to have fellow participants from the same faculty, as this would facilitate feedback.

The need for a course on blended learning was greater than the need for pure online teaching. My advice: only offer a module when there is a genuine need for one, and give participants the opportunity to apply, more or less immediately, what they have learned in the module in their own practice.

Both our modules, which focused on different 'themes,' were organized at the university level. The modules could be used as a part of a professional development course leading to a teaching certificate. This course is available to lecturers in all the different faculties. Although not specifically involved in implementing this particular module, the management was involved in implementing the professional development course as a whole.

To reflect the lecturers' actual teaching conditions as closely as possible, we decided to use Blackboard as a virtual learning environment, since this is the standard virtual learning environment at Utrecht University and UMC Utrecht and lecturers were already familiar with it.

The module at the University of Amsterdam was organized at the faculty level, i.e. the Faculty of Science, and in the context of an ICT-in-teaching innovation project. Each of the participating lecturers in this project worked on his/her own course (re)design, in which they introduced ICT in their teaching. For example, they implemented 'voting' as an activating teaching method in their course.

The lecturers who enrolled in the teaching certificate program at the same time could use their course redesign and the teaching materials they developed in the project as evidence of their competence in teaching design and quality control.



The module was organized at the institutional level at Amsterdam University of Applied Sciences (HvA). There were only a few participants. They came from different parts of the organization and 'volunteered' themselves. Other than giving its consent, the management was not involved. The module was not dedicated to a specific group of lecturers, so it was not adjusted to a specific teaching situation.

Having a small group of participants meant that there was not much group interaction in the virtual learning environment.

The positive effects of having a rather small group were that the moderator was able to link the participants' goals to the local circumstances, since he knew the participants' work conditions (such as the level of local support, policy, hardware and software, and specific implementation projects that were already under way).

TU/e

An existing module in the university's teaching certificate program was adapted to include several elements of the MARCH^{ET} modules. The participants first investigated the different tools and chose one tool to implement in their teaching. They then redesigned their course to integrate the chosen tool. Finally, they presented their course redesign to the other participants in a face-to-face meeting. We used the MARCH^{ET} resources, particularly the wikis with tool overviews.

***Tip:** First consider which tools are available at the institution before searching for external tools. In many cases, the institution actually has more available than teachers realize!*


Settings
Mail
Safari
iPod
Phone

2. Social Bonding

Online courses have often a high drop-out rate. Participants can leave the online environment with just one click of the mouse. Social bonding is therefore considered an important means of keeping participants committed, active, on track, and, above all, 'connected.'

The relationship of mutual engagement is the element that binds members together into a social entity (Wenger, 1998). Research on the formation of communities of lecturers (who did not become accustomed to learning together as students) emphasizes this aspect. For example, Grossman et al. (2001) and Admiraal et al. (2012) identified face-to-face interaction, dialogue and trust as necessary elements for building social cohesion in communities of lecturers. Using social ties to 'bind' participants to the learning module and to one another will therefore increase their chances of finishing it successfully.

To establish social ties, a proper introduction and teambuilding activities are a good – and important – starting point. On the other hand, explicit teambuilding activities take a lot of time. Requiring busy university lecturers to devote this time to a course can have the opposite effect and result in drop-outs. Instead of specific teambuilding activities, the module's moderator can create a social bond by encouraging collaboration between participants. In other words, instead of a social bond being a prerequisite to effective collaborative learning, it becomes *the result* of it. When viewed from this perspective, the moderator's role shifts from the 'provider of teambuilding activities' to the 'conductor of a successful collaborative learning experience.' For instance, in order to establish trust and social bonding between participants, the moderator can offer the participants multiple simpler tasks that slowly increase in complexity. The participants can thus achieve many 'small successes' together, which will be reinforced in multiple cycles (Van der Pol, 2010). They will develop a set of different ways to collaborate (Wenger, 1998) that they can fall back on and that will improve their confidence and motivation.

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Recipe for 'Social Bonding'

Ingredients:

- *Buddy system*
- *Existing social structure*
- *Sense of community*
- *Trust*
- *Activities with shared success*
- *Peer feedback*

Integrate activities that bring shared successes

Regular collaborative learning tasks that participants can complete successfully and on time help establish a sense of community. Successfully completing collaborative tasks helps build and sustain motivation, trust, and an interactive repertoire. It is much better to 'prevent' failure than to 'repair' it afterwards. Once a group becomes demotivated, it is hard to turn it around, so make sure that the collaborative assignments can and will be a success.

Create buddy systems

In the buddy system, moderators create pairs of participants. These buddies only team up for some of the collaborative assignments, but are also expected to keep in touch regularly (preferably face-to-face). They serve as each other's first line of support when questions arise, and should check up on each other between regular meetings. Pairs can also be trios, but the idea is to keep participants collaborating in the same small subgroups throughout the module.

Use the existing social structure

Try to find participants who already know one another, or who share the same research discipline. They will make ideal buddies, not only during the module for the reasons explained above, but also

after the module is finished. Another way to improve social bonding is to add pictures of the participants alongside their online profile or activity. This will increase participants' sense of social presence online.

- *Use peer feedback*

One effective collaborative learning method is peer feedback. The participants respond to one another's work and reflect on their own work at the same time. Be aware, however, that this is also a process that can easily lead to drop-outs, as the participants depend heavily on their peers. If a participant has not finished the assignment (for example their draft course (re)design) in enough time to receive feedback, or has offered feedback without receiving any in return, the effects can be very harmful for the process and demotivating for the future. It is important to see that the participants carry out peer feedback assignments and that they are aware of the importance of the whole process and the deadlines.

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Advice from our tasters: helpful hints

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We organized three video conferences. The first one, at the start of the module, was to get to know one another, since we had not met beforehand. We sent weekly emails to inform the participants about deadlines and about fellow participants' activities. But it remained challenging to create a 'classroom feeling' between participants who were not in the same physical location.

***Tip:** A kickoff meeting should not take too long (maximum of 1.5 hours). Consider generating more interaction during the module: more video-conferencing sessions or more synchronous peer review. If possible, organize the first meeting face-to-face to introduce the participants to one another, explain the module and set the ground rules.*

TU/e

During the face-to-face meeting, the participants introduced one another based on information they were able to find on the internet. It's a fun way to get to know one another and can be an eye-opener when it comes to digital identity.

One module was organized as a part of a Faculty of Science teaching certificate program in which the participating lecturers started as a group. Most of the participants worked in the same building and already knew one another. Participants paired up with peers to give each other feedback on the course (re)design.

***Tip:** From the moderator's point of view, it is important to ask the participants (or let them ask one another): 'Why did you design the course/this part of the course this way?,' not only in order to understand their design, but also to hear their opinions on good teaching. Such discussions are also very 'bonding.'*

To encourage social bonding, we planned a face-to-face introduction session. This was easy to organize, since all the participants teach at the University of Utrecht and/or UMC Utrecht.

***Tip:** You should always use pictures of participants if you are working in a virtual learning environment. It is a good way to make it more personal. Unfortunately Blackboard does not offer this option, but social networks such as Ning or Facebook do. The pictures give the participants and the moderators a better sense of who else is participating in the module.*



3. Degree of 'Blendedness'

The idea of offering courses completely online, without any limits on time or place, is very attractive. Participants can adapt their learning process to their own priorities, pace and available time. In 2011, thousands – and sometimes even hundreds of thousands – of people enthusiastically applied to enroll in massive open online courses (MOOCs). Some commentators predict that MOOCs could change universities' business model (Daniel, 2012). On the other hand, MOOCs have huge numbers of drop-outs. Purely online courses face certain difficulties when it comes to a lack of presence and 'immediacy' for the participants, together with possible gaps in expected prior knowledge, both of which can cause participants to drop out.

Unlike face-to-face modules, it is easier in professional development modules implemented purely online to ignore the participants' need to establish a sense of community, with adequate levels of group cohesion, trust, respect and belonging. All these factors are important when applying acquired knowledge to improve one's own teaching practice.

Blended courses contain both online and face-to-face elements. This offers two major advantages compared to purely online courses. First, face-to-face communication allows participants to conduct certain types of activity more quickly and efficiently, such as brainstorming, scheduling or making decisions and creating agreement (Meyer, 2003). Face-to-face meetings are also better suited for 'triggering' events at the beginning of a module, such as posing a problem and getting everyone involved and committed (Vaughan and Garrison, 2005). Compared to a purely online module, online discussions in a blended module can be more reflective and more rigorous, and make it easier to track ideas (Akyol, Garrison, and Ozden, 2009). Second, incorporating face-to-face components in a module helps to create social bonding and increase the sense of community. It provides participants with more social common ground, giving them a 'head start' in their online collaborative knowledge-

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building activities. In this way the participants can put more effort into the cognitive part of the process, thereby achieving higher levels of collaborative knowledge-building and better individual learning outcomes.

The level of blendedness of a module is closely related to the dimension of social bonding. Combining offline and online activities will generate a stronger feeling of community. The face-to-face activities help establish social bonding quickly within the group, while the online activities help sustain it. Even if the face-to-face activities are purely cognitive-oriented, the participants' social ties will simultaneously grow stronger than if they were performing the same activity online.

Face-to-face meetings are not always possible. Online group meetings are a fairly good substitute for face-to-face meetings if the functionality of the online meeting tool used meets the requirements for collaborative learning: document exchange, (synchronous) collaboration on documents, sharing applications, video and audio of sufficient quality and chat.

Recipe for 'Degree of Blendedness'

Ingredients:

- ***Face-to-face kickoff meeting***
- ***Flexibility to organize own work***
- ***Strict deadlines***
- ***Gentle reminders***

Organize a face-to-face kickoff meeting

A face-to-face kickoff meeting is an efficient way of creating social ties and common ground. It helps participants engage faster than a video-conferencing setting. It is easier during a face-to-face kickoff meeting to relay information and discuss how to complete online assignments as effectively as possible for each participant.

Organize additional online or face-to-face meetings

Plan regular meetings (online in a video-conferencing setting or face-to-face) with the whole group before the start of the module. Additional meetings can be organized by subgroups or buddies. One effective way to achieve this – and to make sure it really does take place – is to plan informal 'guidance' meetings between the moderator and the subgroups. If face-to-face meetings are not feasible from a practical point of view, organize video conferences. Although communication by video lacks the maximized social experience of face-to-face 'presence,' it will contribute considerably more to collaboration and to 'momentum' than e-mail or discussion group exchanges alone.

Organize flexibility in working on assignments

The participants are attending the modules in addition to their regular work, such as teaching and research, and their priorities may therefore change during the course of the module. Online assignments can give participants the opportunity to organize their work flexibly, so that they can do them at times that suit them best. On the other hand, when peer feedback activities are planned it is very

important for all the participants to agree and stick to strict deadlines. That is not always easy. In the MARCH^{ET} modules, the assignments are closely related to the participants' teaching tasks. The deadlines for the assignments and peer feedback within the module should be synchronized as much as possible with the deadlines that the participating lecturers have to meet within the curriculum when preparing their courses. The participants should be given enough time for assignments to allow them to plan their own time flexibly, so that they can complete the assignments, create materials on which they can receive feedback, and use these in their own teaching practice. The deadlines need to be clear and published online, and the moderator needs to send the participants gentle reminders about approaching deadlines.

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Advice from our tasters: helpful hints

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We started with a face-to-face meeting, but during the module itself we organized video conferences. I think that if all the participants work in the same city, it might be easier to have face-to-face meetings instead of video conferences. Even then, having at least one video conference can be a valuable experience; it gives participants an opportunity to practice this form of online communication.



In our case the module had only one social online activity. The participants had to write a blog entry on using the university's electronic learning environment. Not all the participants did this, as they did not all feel the need for online activities. However, the participants were interested in one another's impressions of the learning environment during the face-to-face meeting. They preferred personal contact over online contact.



Since all our lecturers worked in the same building, we organized only face-to-face meetings. We started with a kickoff meeting and after that the lecturers worked independently on their own course (re)design. When most of the participants had implemented their (re)design, we organized a second face-to-face meeting to talk about our experiences in teaching practice. We used Blackboard, where the participants were authorized to upload their documents in order to make them visible for their peers and offer one another feedback.



Our whole module was organized online, but we also organized three video conferences and had regular contact by email. I think these two elements were crucial to the success of the module.

***Tip:** Participants appreciate interaction by video-conferencing. Providing peer feedback during a video conference is a natural way to intensify social interaction. The face-to-face kickoff meeting can also be organized at the local level, using the subgroups or buddies. This leads to easier collaboration online.*



Most of the products of the assignments were used as input for face-to-face discussions. The participants presented their results in the group, and the others asked questions and gave feedback and tips. When the documents or results were presented in the virtual learning environment, only a few participants offered feedback. This shows the importance of face-to-face discussions. The participants even asked for an extra face-to-face meeting at the end of the module, to wrap things up.

However, the virtual learning environment was useful for the moderator: if any participants had not uploaded material close to the deadline, the moderator could easily contact them to ask about their progress.



4. Content & Assignments

The content and assignments offered in the module should reflect the needs of the participants. This ensures that the participants' learning during the module is tied to their own context and actions, as suggested in the TPACK model (Koehler & Mishra, 2005). We know that knowledge and meaning cannot be separated from context, and that they exist only in relation to a person and a situation (Bereiter, 2002). By attuning the content and assignments to the participants' needs, the technological, pedagogical and content knowledge that they gain during the module will be real, relevant, and meaningful to them. The MARCH^{ET} modules (see Part Three) are designed to create scope for such contextualization. Following the 'learning by design' philosophy (Koehler & Mishra, 2005; Laurillard, 2012), the assignments proposed in the MARCH^{ET} module design support and challenge the participants to actively construct their own meaningful and contextualized technological, pedagogical and content knowledge by (re)designing their own teaching.

When contextualizing the module content, the quantity of learning materials provided should always be in balance with participants' capacity to absorb them. The likelihood of participants achieving deep learning will increase if they are not overwhelmed by content. Here, the golden rule is 'less is more.' The MARCH^{ET} modules offer a comprehensive range of information on the topics covered. In order to create the right amount of *focus* and *momentum* in executing a module, we recommend narrowing down the available topics to a selection. For instance, in a general module on collaborative knowledge-building, the moderator can choose not to cover all forms of collaborative knowledge-building, but instead to 'zoom in' on a selection of topics – for example, on 'online discussion' or 'peer feedback.'

The same evidently goes for the module's assignments. When contextualizing an assignment, it is very important that the participants clearly see the reasoning behind the assignment. In order to feel committed to the goal of the assignment, participants need to know *why*

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they have to do it. The moderator has less opportunity to explain the assignments in the self-discovery learning approach of MARCH^{ET} than in traditional face-to-face courses or workshops. It is therefore even more important that learners can identify the intended learning outcomes directly, in the assignments themselves. The MARCH^{ET} modules are designed so that each assignment builds on the ones preceding it. This does not mean that participants have to complete all the assignments in the MARCH^{ET} module for the module to be successful. On the contrary, the added value will only be generated when the assignments build on one another, so that the participants see the time and effort invested in the assignment as 'worthwhile.' By adapting and contextualizing a module's content and assignments to the needs of the participants, the moderator has an important role in creating a balanced and appreciated learning process.

Recipe for 'Content & Assignments'

Ingredients:

- ***Goal of the learning material***
- ***Clear reason behind assignments***
- ***Problem-based learning***
- ***Contextualization of content and assignments***
- ***Guiding role of the moderator***

Clarify the goals of the learning material

The module's structure should make a clear distinction between 'required reading,' which should be read by all the participants and discussed during the module, and 'optional reading.' The collaborative assignments can only be successful if each of the participants has prepared properly beforehand. It is preferable to offer the 'optional reading list' later on in the process. That way, you give the participants the opportunity to learn more and at the same time send a clear signal that they can go a step further in their learning, rather than only achieving the goals of the module.

Contextualize the content – select the right literature for the target audience

The 'required reading list' should be appropriate for the participants of the specific module. If you organize the professional development module at the local level, you have more opportunity to fit the 'required reading' to the specific discipline of the participating lecturers, such as the natural sciences, the social sciences or economics, and to the type of courses they teach, such as more theoretical or more practical or laboratory courses. The list might also depend on whether the participants teach at a research university or a university of applied sciences. Although we recommend adapting the list, that does not mean that you should change everything. Give the participants the opportunity to come into contact with new ideas and challenge them to leave their comfort zone, to explore and to experiment with new ideas.

- *Fit the assignments to the participants' needs and possibilities*

The degree to which lecturers participate may depend on how much time they are able to invest or by their interest in specific educational content. It is important to be sensitive to their limitations and needs when setting up the module, so that you can avoid disappointments or frustrations. The use of clear examples that suit the participants' needs is crucial for their motivation.

- *Identification and ownership – implementation in teaching practice*

The MARCH^{ET} module assignments are problem-based. They are designed to help lecturers resolve their own teaching issues or their students' learning problems. By working on these assignments, the lecturers come to identify with their own cases, deepening their sense of 'ownership' of the course (re)design they have produced, the teaching methods they have chosen, and the corresponding ICT tool. That sense of ownership is important for implementing the course (re)design into their teaching practice. It can be strengthened when the module starts by means of 'educational pull': a thorough discussion of the educational goals they wish to attain, before introducing any kind of technology. This is especially recommended if the participants still need to define precisely what their students' learning problem is. In that case, part of the '(re)design assignment' can be moved to the very beginning of the module so that – in addition to the technical orientation on tools – there is also a pedagogical focus on teaching methods. This change does not require an increase in the total module workload.

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Advice from our tasters: helpful hints

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The first edition of our module was more tool-oriented: it first gave us an overview of what is technically possible at our institution and combined those possibilities with what was preferable from an educational point of view. To deemphasize the content and literature backgrounds, we changed the title of our module to 'redesigning your teaching.'

Tip: *The starting point of our module was: 'What is the right blend when adding technology?' Next time our starting point will be: 'What do you want and need to change in your course for it to be a success?' In other words: the lecturer should formulate an objective for his course, based on a problem in his lessons that he wants to resolve.*

Next time, to reinforce our problem-based approach, we plan to ask the participants at the very first meeting to describe their lesson plan in terms of student activities. If you emphasize the problem that needs to be solved, you can convert it more easily into a goal for change.

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Our module was more focused on the educational application of Web 2.0 technology. 'Good practices' were available in a wiki that was developed during the MARCH[ET] project.

***Tip:** There should be enough time to focus on the learning goals, the educational setting and the available technology. In our case we preferred to use less time for the final assignments (reflection, evaluation).*

TU/e

Our training was more practical in nature. We spent very little time on theory. The wikis developed during the MARCH[ET] project were made available to the participants as ideas for tools to consider in their (re)design. The participants definitely felt ownership during training. We combined all the MARCH[ET] assignments into one big assignment. This gave the participants a better idea of where the module was going.

***Tip:** We would recommend a follow-up after the end of the module, to help the participants implement their design. Without a follow-up, and hence without didactic or technical/functional support, there is a risk that the redesign will not be implemented. Without implementation, the students, lecturer and organization cannot benefit fully from the fruits of the training module.*

The module was very practical and demand-driven. Each lecturer could select a theme, based on the reading list of the MARCH[ET] modules and supplemented by information on other sites, such as 21edingen.nl*. We did not change the length of the original MARCH[ET] module, but we adapted several assignments to meet the needs of the lecturers. The participants were the owners of their educational cases, which covered things they wanted to improve.*

***Tip:** Ideally, there should be one module per theme. This makes it possible for the whole group of participants to focus on a single theme. We expect that the groups within one faculty will be too small for this kind of specialization. We plan to combine more original MARCH[ET] themes within one module and formulate the title more generally, for example '(re)design your teaching with TPACK.'*

The focus of our module was on the pedagogical aspects. Some participants preferred to have more technical information. The reading list for the original MARCH[ET] module was perceived as too long and too difficult, and the participants hardly read any of literature. The academic literature was perceived as too theoretical, as was the whole module. There was a need for a more practical focus during the module and in the assignments.

***Tip:** Our suggestion is to manage the reading list differently: everyone is required to read one article and to search for one extra article. Another suggestion is to improve the correlation between the practical and technical information about the tools. One improvement would be to use a video lecture about instructional design and the role of the lecturer as an instructional designer.*



5. Learning Process & Moderation

Participants in online or blended modules need support and supervision. To some extent, computer tools will do this for them automatically. However, there are three important aspects to group support and supervision that computers cannot (easily) provide, and that are therefore up to the moderator:

- establishing an online teaching presence,
- creating a sense of community, and
- keeping the momentum.

The moderator facilitates discussions, moderates learning activities and supports the participants in their assignments.

It is very challenging to design learning activities in which participants gain technological, pedagogical and content knowledge (TPCK) at their own academic level and, at the same time, apply this knowledge directly in their own teaching practice. The MARCH^{ET} modules make use of problem-based learning, which can be described as 'learning by doing.' The participants reflect on the quality of their course design and receive feedback from their peers and the moderator. The modules are 'student-centered' – or, more precisely, 'participant-centered.'

By facilitating online discourse and providing direct instruction, a moderator creates an online teaching presence that contributes to participants' learning context and sense of community. Persico et al. (2010) stated that an online teaching presence is the binding element in cultivating a learning community. In other words, there is a clear connection between a perceived teaching presence and students' sense of a learning community (Shea, Li, & Pickett, 2006). When attempting to nurture the creation and growth of an online community, it is essential to maintain the module's 'momentum.' This means that the moderator must always try to establish a minimal level of activity. For participants, visiting the online learning environment and seeing their fellow

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participants' and moderator's activity is highly self-reinforcing.

'Teaching presence,' as defined by Garrison et al. (2000), refers both to the teaching and learning process designed for the module beforehand (as explained in the dimension Content & Assignments) and to the students' learning activities and the teacher's supporting activities. As a whole, this teaching presence is an important part of the learners' learning context. It largely shapes the way in which the participants collaborate and determines whether their approach to learning will be at a high cognitive level (deep learning) or at a level where they simply memorize the material (surface learning) (Garrison and Vaughan, 2008; Biggs, 2006). For this reason Garrison and Vaughan emphasize the importance of the role of the 'teacher' in the course design and in the management of the learners' learning context during the time when the course is given.

Recipe for 'Learning Process & Moderation'

Ingredients:

- *Teach as you preach*
- *Moderator as designer*
- *Deep learning*
- *Change teacher's beliefs*

Teach as you preach

When lecturers have to set their own goals, reflect on the assignments, discuss the subject, provide peer feedback to one another and use the feedback they receive to improve their own work, they enter into a rich 'student-centered' learning process that stimulates knowledge construction by the learners. According to the principle 'teach as you preach,' the 'student-centered' teaching methods in the module give the participants the opportunity to experience the student-centered learning process themselves, something that will encourage them to design student-centered learning activities in their own teaching.

Contribute as moderator to designing 'learning experiences'

A moderator supports and guides the assignments in the module. The moderator needs to reflect on the level of cognitive challenge that the learning activities will provide: What 'cognitive conflict' will the participants encounter? What questions will they pose? What conclusions will they draw? And, most importantly: How can a moderator make sure that the participants will successfully undergo challenging learning experiences? Answering these questions creates a 'pedagogical scenario' (Laurillard, 2012) that complements the problem-based approach of the MARCH^{ET} assignments by adding the personal touch of the moderator's teaching and guidance plan.

The MARCH[ET] modules aim to trigger inquiry learning – or 'self-discovery learning' – and to stimulate active knowledge construction. As a consequence, each participant moves along his or her own learning pathway. This requires the moderator to be an expert on all three levels: the subject matter, the pedagogical issues, and the tools that the participants will use. The freer the participants are to find their own way to the optimal teaching (re)design, the larger the variety of learning 'pathways' that the moderator should be able to guide, redirect and remediate.

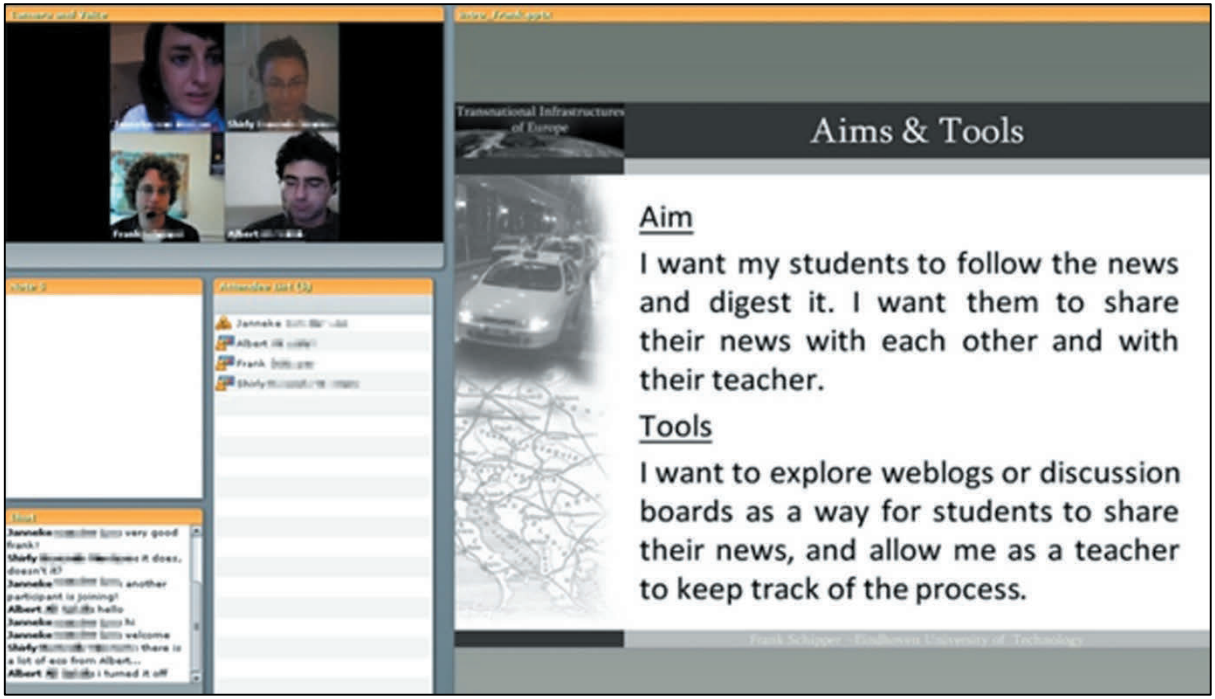

Figure 1.1 Screenshot of a web video conference with three teachers and a moderator

- *Ensure a minimal level of activity*

One important task for the moderator is to keep the teaching presence in the module at the right level. A moderator should give the participants the feeling that the learning process is always going on online, and that there is something waiting for them whenever they log in. This does not mean that they need to be online all the time. The participants should receive an alert about approaching assignment deadlines (automatically or by e-mail from the moderator). The participants' visible activities and the moderator's comments can also stimulate the sense of a learning community.

- *Change the teacher's beliefs by conducting a 'teaching experiment'*

A compulsory assignment in which each participant tests one or more of his own learning activities in practice ensures that they will complete the learning process set in the module. Implementation of the course (re)design is called a 'teaching experiment.' This makes it possible for the lecturer to remain in his or her comfort zone and ask the students to evaluate the course (re)design afterwards and provide feedback on it. The experiment has to be limited in order to ensure its success. This creates a context in which lecturers are able to amend their beliefs about good teaching and acquire more in-depth knowledge about teaching and learning. This will help them to continue experimenting and improving their teaching methods.

- *Send reminders*

Send reminders, regular updates and so on. Complement these with automatic RSS feeds to ensure that the module feels 'active' and 'alive.' Use email alerts from the virtual learning environment (VLE) to ensure that participants keep visiting the learning environment regularly and engage in the collaborative assignments.

- *Stimulate individual participation*

Approach participants individually to ask them to write a message, post a summary or supply any other activity that is needed to stimulate the group process at that moment. Take advantage of times when participants contact you themselves with a question.

- *Acting on the TPACK areas*

Focus on the overlapping areas of content knowledge, technological knowledge, and pedagogical knowledge (TPACK), since the participants will need these areas of interface to accomplish their teaching innovation and to implement their design in their own teaching practice. Act according to the TPACK model yourself, for example in video-conference discussions and when offering feedback.

- *Transparency of activity by participants*

Display participants' activity on the site, making it transparent for the whole group instead of only one person on his or her individual report card. This lets them know that their attendance is being monitored. It can create a sense of 'fairness' by conveying that each participant's activity is as valuable as the next. In addition, seeing active fellow participants will motivate and inspire other participants to follow their example.

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Advice from our tasters: helpful hints

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Each participant worked individually on his or her own teaching course by developing several learning activities or a complete course (re)design. The first assignment of the module was to define the present situation and to make explicit the students' learning problem. Instead of the proposed blog, each participant wrote a pedagogically sound description (max. 2-3 pages) of the course (re)design and evaluated their experiences with it. Most of the teaching experiments were documented on video.

In our case, the moderator was an expert in e-learning. She helped the participants achieve the best TPACK solution for their situation. The groups were small, which made it possible to support the participants personally and to meet their individual needs.

Before the start of the program, all the participants filled in a questionnaire about their beliefs and intentions and about their TPACK. After they submitted their files for assessment, they were asked to fill in the same questionnaire again. There was a significant shift from more teacher-centered to more student-centered beliefs, as well as an increase in TPC knowledge.

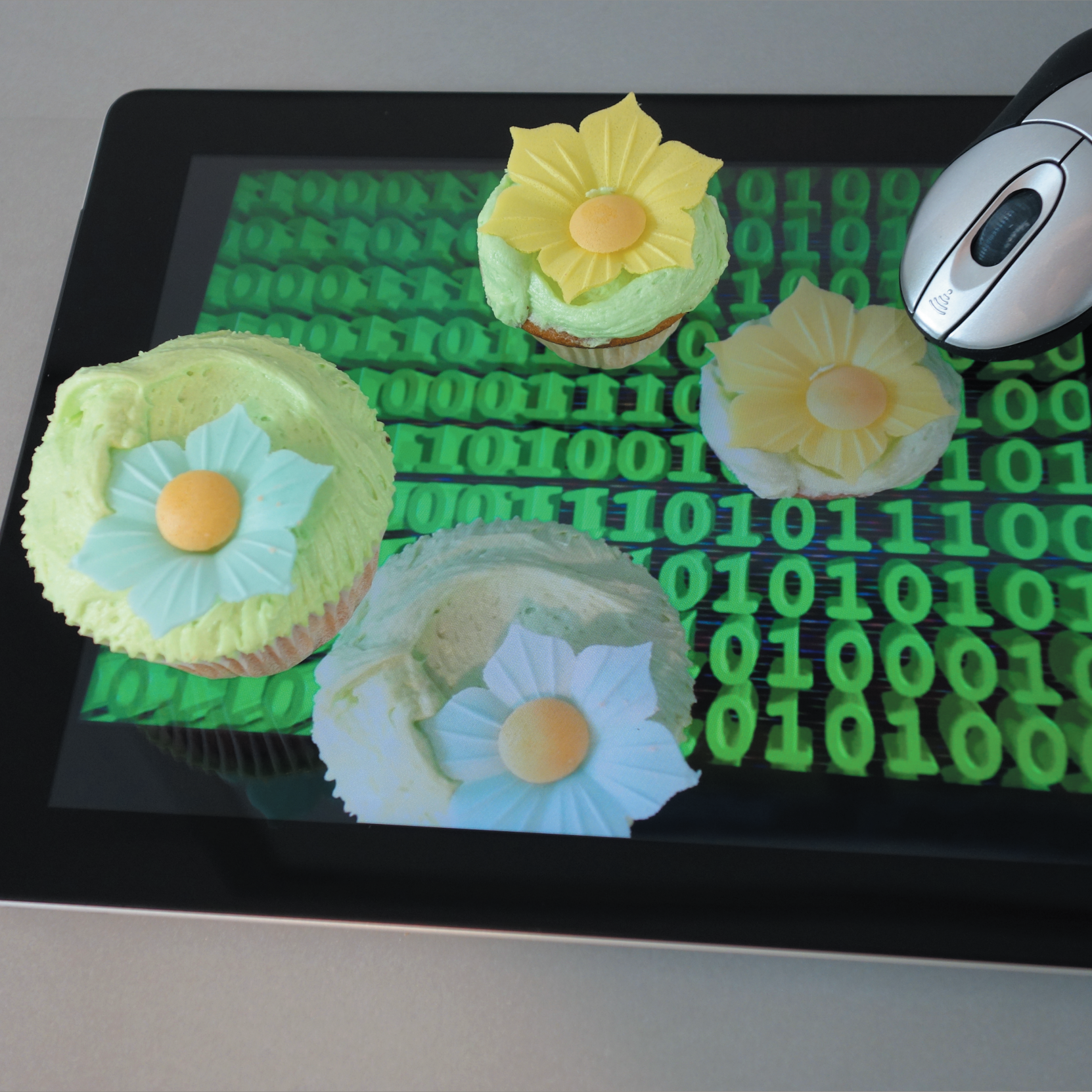
In our module, the face-to-face meeting was compulsory. This meeting automatically led to discussions and peer feedback. The elements of TPACK were discussed to some extent during this meeting. The blog was not compulsory in our module, and that meant that only a few of the participants contributed. The participants chose to learn individually. Two participants undertook a trial implementation (teaching experiment) but unfortunately no data is available on the final implementation.

The role of the moderator during the module was very important. The moderator was almost always online. His weekly emails about deadlines and the activities of the other participants stimulated the sense of a learning community. The support provided by the moderator in the form of comments and feedback on blogs and wikis was highly appreciated. The moderator was content- as well as process-oriented and was experienced in online/distance teaching. He was very familiar with the use of ICT in teaching and learning environments and was actively involved in the design and construction of this module.

***Tip:** Make sure that you divide your time and energy as evenly as possible between the various participants. They appreciate this a lot. Be aware that the moderator may spend more time on the module than planned beforehand.*



The general approach (problem-based, using one's own situation and re-designing it) was very practical. The TPACK approach was used during the course to ask the right questions. Moderators were active: they emailed updates, asked questions, and made sure that everybody kept going. Being a moderator involves having the discipline to constantly keep track of what the participants are doing in the module and to intervene at the right times with the right means.



6. Tools & Technology

The professional development module on using ICT in teaching should itself use ICT tools to demonstrate the 'T' in TPACK. It is also vital to have reliable technology that functions as it should. When lecturers are new to using ICT in teaching, they will often proceed very cautiously. They have yet to embrace the new technology, so the slightest technical hiccups can have negative effects. When technical problems arise, be sure to address them quickly. Make sure that the participants also have a good, easily accessible technical helpdesk that can assist them with technical problems (software, hardware or infrastructure). Besides reliability, there are three key elements that need to be addressed when using educational technology in a professional development module: consistency in content, coherency in tools, and redundancy.

An example of content-related consistency is when participants in the module explaining how to design collaborative learning activities (such as the MARCH^{ET} module 'Collaborative knowledge-building') learn about the theory of collaborative learning in a collaborative learning setting, and that they use the appropriate ICT tools for this. This will help them reach a deeper understanding of the collaborative learning process and become confident enough to use the tools that support collaborative learning in their own teaching. In other words, consistency in content helps the participants construct their technological, pedagogical and content knowledge.

Coherency in tools means that the participants should use the same tools in their own learning activities as they are going to use with their students. They will not only experience the tool first-hand that way, but will have an easier time constructing the technological and pedagogical knowledge that they need to use the tool in their teaching practice. We recommend using the same virtual learning environment (VLE) as the institution uses in order to give the participating lecturers and their own students the same VLE experience. Every tool has its own strengths and weaknesses, and the leturer should be aware of these. Online discussion,

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for instance, offers a space for deep and thorough reflection, but it lacks immediate feedback. Chat, Twitter and other 'fast' synchronous tools provide immediate feedback, which has a lot of benefits, but they often trigger a more or less superficial conversation. Blogs facilitate personal reflection, but they are less likely to trigger interaction by peers. Wikis offer support for creating a joint artifact or a conclusion by the whole group, but they are weak at stimulating peers to participate actively. The weaknesses can be compensated by combining the tools. The module needs to provide the participants with an appropriate learning experience accompanied by proper pedagogical instruction.

Last but not least, you should ensure redundancy. Clarity and transparency are needed in communicating goals and expectations during the module: What precisely are the participants expected to do and when do they need to finish it? Clarity is even more important in online teaching than it is in face-to-face teaching. When it comes to online learning, important information needs to be conveyed clearly and more than once. This might feel a little 'bossy' at first, but the nature of online learning and communication requires this extra bit of clarity and direct communication. When people read information online, most of the time they simply 'quick-scan' through the text. That makes it vital to 'repeat' important information when it is needed, to ensure that the participants have absorbed the message. For example, the main aim of the module should not only be identified in the module description, but should also be conveyed in its design and in the assignments. In the case of the MARCH^{ET} module, the relevant assignments are clearly visible in the navigation menu. This helps participants maintain a clear overview of the module's overall 'framework' at all times, so that they see the reasoning behind the specific assignment on which they are currently working (Figure 1.2).

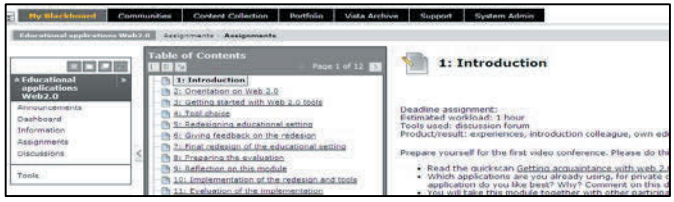

Figure 1.2 The list of assignments in a MARCH^{ET} module set up in Blackboard

Recipe for 'Tools & Technology'

Ingredients:

- *Locally available tools*
- *Double-check before the start*
- *Helpdesk*
- *Experience the tools as student*

Use the local virtual learning environment

Use the same virtual learning environment in the professional development module as the participants will themselves use with their students.

Double-check software and hardware before the start of the module

Promptly check and double-check the presence and correct functioning of all the required hardware and software that the participants will be using in the module. Also check the availability of tools that the participants will be using. Inform participants about the technical helpdesk. If it is not avail-able at all times, organize an emergency backup. This can be a co-worker or even participants who already have more experience.

Make sure that the moderator is accessible

A moderator needs to be very accessible and should react promptly in providing the participants with the information that they need to resolve any technical problem before it causes them to go into a 'panic.'

Experience the tools as a student

The participants should be supported by the same ICT tools as they are going to use with their students. This will help them experience the tool as their students will and better understand the students' situation. It will also help them improve their course (re)design, since integrating the TPACK ingredients will feel more natural.

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Advice from our tasters: helpful hints

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Tip: *Since the new version of Blackboard (9.1) contains blogs, journals, wikis, and of course a discussion board, lecturers could be encouraged to try their tool of choice within Blackboard and compare it with a commercial tool such as Wikispaces, Blogger, etc. This can make them aware of the specific features of every tool.*

The moderators did not have much prior experience using Blackboard or any specific blog, wiki or virtual classroom tool. In practice, this was not a problem. Technical problems were solved by providing instant support.

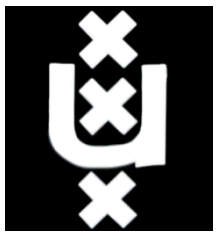
Tip: *Using a new or relatively untested tool or virtual learning environment can create unexpected problems. In our case, the problem was that we offered the first module in Learnplus (Blackboard 9.1). There were quite a number of technical problems and errors at the start. The table of contents was not clear to the participants and the system crashed the first day of the module. Due to the technical problems, the module took more time than planned. Participants needed extra technical support to use the video-conferencing tool and other ICT tools in Learnplus.*



We used a new system, a digital learning and working environment or DWLE based on Microsoft SharePoint, which is set to be the standard environment for our institution. Most of the participants were very motivated to learn how to use it.

***Tip:** Prepare the web conference as thoroughly as possible and do an on-the-spot check of the facilities where participants will be attending the web conference. Use the first face-to-face meeting to practice using the web-conferencing system. Work out questions such as how to go through the sound/speech wizard, and how to use a headset to avoid an echo. This allows the participants to get used to the software before the web conference starts. If they run into technical problems at a later stage, they will be better equipped to deal with them because they will be able to distinguish software problems from hardware problems.*

Check the local support system as well, including the opening hours, and pass on this information to the participants to avoid unpleasant surprises.



Two teaching assistants supported the participating lecturers by solving technical issues and lowering the thresholds. They provided an accessible helpdesk at any time needed during the period in which the lecturers were working on their course (re)designs. The teaching assistants were hired within the context of an ICT-in-teaching innovation project.



7. Planning & Timing the Module

How do you get busy university lecturers to attend a module such as MARCH^{ET} on top of their demanding workload, and to implement the TPCK they acquire in their teaching practice? Careful timing and planning are needed to make this possible. A module needs to be planned long in advance and the start and end dates need to be clear to all the potential participants. The group meetings have to be communicated far in advance, and so do the deadlines set for the assignments. One key success factor for a module is proper timing. The module should overlap as much as possible with the period in which lecturers prepare their courses and teaching materials. That way, the module will support the lecturers in carrying out at least part of the work that they were already planning to do. Combining the module work with their own course preparations can lead to a more fundamental improvement in the course they teach – a course (re)design. The participants will probably want to know how much time they will need for the module. There is no simple answer to this question. A MARCH^{ET} or similar module only involves a few meetings (online or otherwise), but it would be very misleading to only mention the 'contact time' and not the assignments, where the timing is flexible. It is also important to mention that the time needed to complete the assignments differs per participant. Since each of them is working on his or her own course (re)design, the necessary time will depend on the magnitude of the course (or course element) to which the (re)design applies, and on the complexity of the problem chosen by the participant. It becomes even more complex when you realize that the perceived time investment also depends on how the participant interprets the module activities. The question then is: Is the time invested in the course (re)design part of the module, or can it also be seen as part of the participating lecturer's regular teaching tasks? The moderator plays an important role in communicating the time investment issues carefully and in relation to the lecturer's context so that the deadlines can be met. This allows a moderator to provide a lot of positive feedback and to show appreciation when assignments are finished on time.

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Recipe for 'Planning & Timing the Module'

Ingredients:

- ***Just in time***
- ***Enough time***
- ***Clear deadlines***
- ***Flexibility***

Just in time

Make sure that the module is available during the period when the lecturers are preparing their courses. If this is not possible, try to organize it in a less busy period – although we realize that university lecturers have rarely 'less busy periods.'

Schedule enough time between the assignments

There should be sufficient time between the individual assignments (e.g. reading, course design) and the group's interactive assignments (discussion, reply, and peer feedback) so that delays in the former cannot affect the latter.

Facilitate flexibility

The time used for the individual assignments can be flexible within a certain time span. However, several deadlines need to be fixed and clearly communicated, otherwise the peer review process will not work.

Support specific activities

If possible, the timing of the module should be synchronized with an existing educational project, such as curriculum renovation or the development of new courses. That way, the time invested will be seen as doubly useful and participants will experience it as 'meaningful.'

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Advice from our tasters: helpful hints

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The module took place from November 1 to December 16. The participants worked hard during the first four weeks. Later on, however, the deadlines were postponed due to the heavy teaching workload. The timing of the module, close to Christmas, was not optimal. It would have been better to have it immediately after the summer holiday, when schedules are relatively empty, or in spring, when teachers are looking ahead to the next academic year and are making plans to innovate their courses.

The second module started on September 15 the following year and ended on October 31 (6 weeks). The workload was about 25 hours. Assignments developed in the MARCH^{ET} project were used without adaptation. The three video conferences were held during the day. It was good timing to offer the course at the start of a new academic year. The participants started on the course with renewed energy and they were open to innovation.

In practice, the workload turned out to be much heavier than the expected 25 hours (some participants indicated that it was as much as 30 or 40 hours). The participants said it took a lot of time to work through the list of required reading and they perceived this as difficult.

We decreased the length and the workload of the module considerably. Our course took three to four weeks (at first it was designed for ten weeks) and required about ten hours of study time (instead of the originally 25 hours indicated in the MARCH^{ET} module). In practice, the course took a little more than four weeks because we organized extra face-to-face meetings. The participants mentioned that it took them a lot more than the ten hours planned. It was time-consuming exploring the different tools. On the other hand, the participants did not spend much time engaging in online reflection.

Tip: *Fix dates long in advance.*

Tip: *The beginning of the academic year (September in the Netherlands) can very busy for lecturers and they will not have the opportunity to apply for the module.*

Note that extensive communication about the module is necessary. In our case, lecturers complained afterwards that they did not know about the module, which they would have liked to attend.

TU/e

Our module involved a three and a half hour, face-to-face training workshop with preparatory assignment to investigate tools and draw up a course redesign. Our participants needed about three hours for their redesigns. The training workshop combined the various themes of the four MARCH^{ET} modules. The participants could choose which topic they wanted to address. This worked well. In our experience, the output was comparable to that of a full-length module.

Tip: *Organize the module at least twice a year.*



8. Participants & Recruitment

Lecturers who apply for a module need to know what will be expected of them. To begin with, they should be given a clear description of the goals of the module. Often, however, people do not take the time to read a detailed course description. To ensure that participants know what is expected of them, and what they themselves can expect from the module, it is advisable to arrange a short but transparent recruitment process before the module begins, including a brief intake interview (by phone). Participants who want to attend MARCH^{ET} modules must meet two requirements. These requirements need to be clear to the participants to prevent wrong expectations, disappointment and drop-outs.

The first requirement is that the participants must be lecturers who are actively involved in teaching. Lecturers at university basically design their own courses. The module will show them how to integrate their technological, pedagogical and content knowledge (TPCK) into the (re)design of the course that they are teaching. The same process takes place whether the lecturer (re)designs only one learning activity or a whole program. In the case of a complete course or even a curriculum involving more than one lecturer, it is advisable for the whole team of lecturers to participate in the module.

The second requirement for MARCH^{ET} module participants is that they should each teach their own course and have specific educational questions or learning problems that they need to solve. During the module, the participant will produce a course (re)design that addresses that specific problem and integrates technological, pedagogical and content knowledge (TPACK). Each lecturer will evaluate the success of the (re)design in his or her own teaching practice, reflecting on the original learning problem. If participants who wish to attend the module do not meet this requirement, they will not improve their TPC knowledge efficiently.

It helps to put together a homogeneous group of participants working in the same discipline, for example a group of lecturers in organic

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chemistry or in English grammar. That way, the participants will have a better understanding of one another's learning difficulties and of difficult concepts, and peer feedback at the interface of content and pedagogy and of content and technology will be of higher quality. The participants will understand more thoroughly how to teach a difficult concept and why, and can share discipline-bound applications and useful tips. Unfortunately, it is not always possible to create mono-disciplinary groups. Moreover, there are also many advantages to having a multi-disciplinary group: the participants have more opportunity to think 'out of the box' and learn new things from one another while engaging in 'constructive cognitive conflict.'

Recipe for 'Participants & Recruitment'

Ingredients:

- ***Lecturers***
- ***Intake interview***
- ***Composition of groups***
- ***Leaning problem***

Recruit lecturers who design their own teaching

The participants you recruit should be lecturers who design their own teaching. This has to be communicated to the target group far in advance.

Organize intake interviews

Phone the people who applied for the module for a short intake interview (a video call is preferable). Check whether they fit the target group of the module, ask them about their expectations, and clarify the 'problem' that they will be working on in the course (re)design. Do not forget to summarize the goals briefly, explain the module schedule and discuss the degree of flexibility in the participant's own planning.

Let the participants define a student learning problem

The participants enter the module with a 'need' to address the pedagogy or educational technology in their own teaching and to redesign their own course. Have them explicitly define the 'problem' before the module starts so that the learning outcomes can be set. Measurable improvement can be

achieved only in the event of a course redesign or teaching experiment (e.g. a series of learning activities) where the explicit goal is to improve students' understanding of specific concept or to improve a specific pedagogical method.

- *Think about the composition of the group*

Pair the members of the group into buddy teams so that participants with approximately the same teaching experience can collaborate. If possible, pair participants working in the same disciplines. This will allow them to give each other feedback about the pedagogical content domain and to discuss the best methods for constructing knowledge about a particularly difficult concept. If this is not possible, do not forget that mixed groups also have numerous advantages and can open up new perspectives.

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Advice from our tasters: helpful hints

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The target group consisted of lecturers who have concrete plans to use interactive ICT tools in their courses, such as a blog, wikis, the virtual classroom and a discussion forum. The group was heterogeneous in terms of discipline but homogeneous in their degree of experience with online learning. This did not hinder the learning process. We recruited people from the 'e-learning' project team. They were not all lecturers but they were all involved in course design. The best recruitment strategy is to contact people personally.

Tips: *We suggest forming groups within a single faculty, where the participants all work in the same discipline and the same context. Also, only recruit participants who already work with online learning environments or will do so in the near future. Only this will afford them enough opportunity to put the knowledge directly into practice.*

Most participants will enroll in the module if you contact them personally. A general message in a weekly or faculty newsletter is NOT a successful method for recruiting enough participants.

In our case, two of the six participants joined the module just a few days before the start. Due to the limited number of applicants, we were unable to select. One person dropped out after the intake interview, and another dropped out in the first week.



All the participants had different goals, different backgrounds, different approaches, and different levels of ICT skill. Besides these differences, they also had different views on what they regarded as good teaching. Maybe because of all these differences, they asked one another a lot of questions, in order to understand one another's work. And they learned a lot from one another.

The participants were all lecturers who would soon be making use of the new digital learning and working environment at our institution, the DLWE. One of them was even responsible for encouraging his fellow lecturers to make use of blended lessons.

***Tip:** More diverse recruitment activities are needed, as well as a 'need' that has to be addressed in the lecturers' own teaching practice. We expect that the new possibilities of our digital learning and working environment (DLWE) will encourage more lecturers to enroll in the module in the future.*



The participants were lecturers with some teaching experience. Most of them were experienced in working with ICT. We invited lecturers who were enrolled in the teaching certification program. We also recruited lecturers who had just obtained their University teaching certificate and who had expressed a wish to learn more about ICT-enhanced teaching design.



Our participants in the 'Measuring Knowledge and Insight' module were all lecturers. Although they all had a lot of teaching experience, the group was quite heterogeneous. Some of the participants gave workshops about the quality of knowledge tests, but one participant had never before constructed a knowledge test. At the time that we organized the module, our institution had just introduced a new assessment policy. We referred to the relevant institutional documents and adapted the module contents accordingly. That meant that the module helped all the participants cope with the new policy.

***Tip:** Simply announcing the module in a mailing list or a newsletter is not enough to recruit lecturers who indicated their interest in the past. Other means are needed as well. In our case, we announced the module during various project meetings. It is also important to check on time whether other people have sent out information as pre-arranged, in order to avoid unpleasant surprises.*

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All our participants were lecturers. They had little experience designing courses but a significant amount of experience using computers and information and communication technology. Although the group was heterogeneous, they were all willing to learn.

***Tip:** Use a general intake interview or a session of the University Teaching Qualification (BKO) program to publicize the module. That way the module can be included in the advice offered to each lecturer about the best route to a teaching certificate. The products that the lecturer produces in the module (such as the course redesign) can provide useful evidence of his or her competence.*


Desserts

9. Goals & Expectations

The participants must have a clear idea of the goals of the module and what they can expect from it. When participants have realistic expectations, the group atmosphere benefits and the participants will think more highly of the module at its conclusion. There will be more participants from the appropriate target groups and fewer drop-outs.

The ultimate goal of professional development is to improve student performance. In the case of the MARCH^{ET} modules, the participants learn to produce a sound course design and implement TPACK in their teaching practice. The MARCH^{ET} modules have the same general subgoals (more about this in Part Three):

- Describe the main theoretical concepts related to the subject of the module.
- Choose a relevant tool based on the educational content and chosen pedagogical approach (TPACK).
- Experiment with at least two tools during the module.
- Redesign the educational setting according to the TPACK model.
- Implement the course (re)design in your own teaching practice.
- Evaluate and reflect on the course (re)design and the success of its implementation.

These goals are situated at different cognitive levels according to Bloom's Taxonomy (Anderson & Krathwohl, 2001), from remembering to creating knowledge. They deal with factual learning and processes and they include metacognitive activities.

To reach these goals, two requirements must be met. First, the participants' expectations and the goals of the module need to be aligned. Second, the participants need to identify a concrete learning problem in the course they are currently teaching. As stated in the previous chapter, one of the key success factor for the MARCH^{ET} modules was an intake interview with each applicant, which allowed us to check whether they fulfilled these two basic requirements and to align mutual expectations. It is a

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good idea to let the moderator conduct these interviews because this helps establish his or her social ties with the participants. That is even more important when the module is solely online.

Besides making sure beforehand that all the participants are in 'the right place,' it is important to discuss the expected time investment as well. The participant's personal goals largely define how much time he or she will need to invest in the module. If a lecturer wants to redesign a whole course, this will take more time, but it will also increase his or her motivation to implement the (re)design in teaching practice. The goals of the redesign must, however, be shared by the other lecturers who are teaching the same course but not participating in the professional development module. If the goals are not shared, the co-lecturers will not cooperate sufficiently in implementing the teaching design. In that case the participant would be better off restricting the course (re)design to an experiment in which he or she (re)designs only one or two learning activities for the sessions for which he or she is fully responsible. If the experiment turns out positively, the team of lecturers will be motivated to continue and redesign a whole course the next time around.

Recipe for 'Goals & Expectations'

Ingredients:

- *Study guide*
- *Personal goals*
- *Interconnections*
- *Experiments*

Use a study guide

Communicate goals and expectations clearly in a study guide. Make sure that participants have read the study guide before the first meeting. The intake interview is the place to check this. Pay special attention to the module's expectations during the first meeting and reserve a specific place for these on the website.

Communicate the requirements

Use the intake interview to check whether the applicants meet the requirements and are in the right place in the module. This will prevents drop-outs afterwards.

Sharpen personal goals

Discuss the personal goals and the educational problem of each participant during the intake interview and give them an assignment to sharpen their focus if necessary. Let each participant present their problem case during the first meeting. Find common problems and pair up participants into peer feedback teams, taking their personal goals into account.

Encourage interconnections

Encourage participants to combine their course (re)design activities with course maintenance and curriculum development activities. This will reinforce their goals and make it possible for lecturers to invest more time in the (re)design. It will also encourage more lecturers to get involved in the redesign.

- *Encourage experiments*

If a participant's goals are too ambitious, encourage him or her to restrict the course (re)design to a single learning activity and set him or her an experiment. He or she should give this experiment a sound, constructively aligned teaching design using the TPACK model, and evaluate it afterwards with his or her students.

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Advice from our tasters: helpful hints

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Intake interviews were held using the web conferencing tool Elluminate. The intake was conducted by one of the module's moderators, who was also one of its designers. After the interview, one participant decided to withdraw because the expected workload was too high.

Although we held an intake interview with all our participants, after the module they felt that their initial expectations had not been met to their satisfaction. They perceived the module as too theoretical, and needed more time to finish than they had expected. In our case it was not possible to find lecturers who met all the requirements, so we ended up admitting participants who did not. For example, two participants joined the module shortly before it began because they had just started their new job as lecturers. That meant that they had no opportunity to formulate expectations or identify a learning problem that they wanted to solve.

***Tip:** If the intake interviews with prospective participants are conducted by persons other than the moderator (not recommended), make sure to share the information collected about the participants beforehand.*

***Tip:** Invest in effectively disseminating information about the objectives, the structure of the module and its demands. In other words, invest in expectation management. This will prevent drop-outs.*

Tip: *During intake interviews at universities of applied sciences, it might be relevant to ask the management's views on using ICT, and to also ask about local ICT support. It is important to know whether a participant is a self-driven innovator or whether he or she will need to adapt the course design to local policy.*

One of our modules was integrated into the University Teaching Qualification program (BKO). The goals of the module were communicated during the general intake interview for the program. Each lecturer could work on his or her own teaching redesign project according to MARCH^{ET} principles and the TPACK model. The first step in this individual case project was to define a student learning problem that needed to be addressed by the lecturer. The description of the lecturer's pedagogically sound course (re)design could be used as evidence for his or her teaching certificate. A special template was designed for the case.

The lecturers who enrolled in the BKO program at our institute were asked to fill out the same questionnaire concerning their beliefs and intentions at the beginning and at the end of the program, including their beliefs concerning TPACK as used during the MARCH^{ET} project (Rienties et al., 2012). The results showed that the professionalization efforts had been successful, since the participants not only produced sound course designs but also shifted from a belief in imparting information at the beginning of the module to facilitating learning at the end. In the self-evaluation, they indicated that they had made progress in TPACK in all the relevant categories (Brouwer, 2012).



The goal of this local MARCH^{ET} module on distance education was to introduce teachers to an online learning environment and how they should behave in it. The focus was on introducing the teachers to the concept of the community of inquiry and its importance in online courses. One important element was 'teach what you preach.' Each section followed the format of problem-based learning. A case was presented in a text format or video. The assignment consisted of a question at the end and participants were given required and optional literature to read. At the end of the week, participants had to turn in an answer to the question, either individually or in a team. The answer had to be handed in via a blog, in a wiki or via Dropbox.

The module had four sections. The goal of the first section was to give participants practical examples of online courses currently offered at Maastricht University. Participants had to watch video clips before the first video conference, which was the kickoff meeting for the course. In those clips, the online course coordinators described their course, their view of the success factors for online learning, and the role of the teacher. The second section presented a summary of academic literature on the success factors for online courses and the characteristics of online students. Via a wiki, participants had to relate the factors to the online courses offered at Maastricht.

The third and fourth sections went deeper into the subject of the teachers' role in online courses. The focus of the third section was the role of the teacher. It discussed topics such as how to create a community between participants. This section ended with a video conference in which the participants discussed the assignment. The final section dealt with social interaction and how a teacher can encourage interaction between participants. This section once again ended with a video conference. After this, participants had two weeks to submit the final assignment.



10. Policy

The final aspect that influences the success of MARCH^{ET} and similar modules is the degree to which the module is in tune with the institution's views about using ICT in teaching. Organizing the module at the local level, i.e. the institution, makes it possible to align the module with institutional policies on the professional development of teaching staff. This means it can be integrated into the general professional development program for a teaching certificate, or into the institution's policy on lifelong professional development. Conversely, the modules can help alter views about using ICT in university teaching in general and highlight the importance of applying TPACK in course design in particular. They can help define a policy concerning the ICT-related knowledge and skills that lecturers must learn to apply in academic teaching. The institution's policy might not recognize that lecturers involved in designing university teaching must be able to integrate and apply technological, pedagogical and content knowledge. From an institutional point of view, it might be easier if the more practical subgoals of the MARCH^{ET} module become part of institutional policy first, with the TPACK model then being adopted as a concept.

Aligning the professional development modules for the teaching staff with the institution's policy has several benefits. First, the modules will be communicated from different points within the institution. Second, lecturers will feel a greater need to apply and will find it easier to make time for a module – even when it is not compulsory. Third, alignment with institutional policy will make it possible to organize the necessary technical and financial support for the module. When stakeholders and institutional management share the same view of the TPACK model, momentum increases and awareness of the modules is raised within the institution. As a consequence, the insight that the TPACK model is indispensable to educationally sound, ICT-enhanced course design will spread throughout the institution and reach all the lecturers by natural means.

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Recipe for 'Policy'

Ingredients:

- *Existing programs*
- *Existing projects*
- *Policy of the institution*
- *New ICT projects*

Align the module with existing programs

If a professional development program (such as the University Teaching Qualification) is already up and running within the institution, integrate the module into this program. This will ensure that the pedagogical vision expressed in the module is fully aligned with the institution's own vision and make the module much more successful for the organization.

Align the module with existing quality control policies

Try to involve key figures when demonstrating the need for the module and its success afterwards. If there are already projects at the institution focusing on improving the quality of university teaching or student academic success, link the module to these projects in order to collect data and interpret them within the context of total quality improvement.

Integrate the module with ICT-in-teaching innovation projects

If your institution already has ICT-in-teaching innovation projects under way, link the module to them. Apply for grants for teaching redesign projects at the university, or encourage potential module participants to do so. Ask the local management whether you can conduct a small-scale ICT-in-teaching innovation project. This will help you organize a helpdesk or make it possible to hire student assistants for specific technical issues.

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Advice from our tasters: helpful hints

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Our module's design and degree of blendedness have had an impact on the courses that we use and develop. More and more courses will have a design similar to this one. The blend worked well, and so did the problem-based approach. We also hope to benefit from the wikis used. At our institution, we are currently working on improving our vision and mission using social media/ICT in education (called 'Learning Tomorrow'). Besides using the digital learning and working environment (DLWE), we expect it will be easier to integrate technological and pedagogical knowledge (the TP interim phase of the TPACK model). This will have an impact on the lecturers' training and can be combined with current moves to put more effort into our lecturers' professional development.

*The means to implement the module were provided partly by the MARCH[ET] implementation project and partly by UMC Utrecht, the Educational Technology Team and the Centre for Teaching and Learning (Utrecht University). UMC Utrecht has a program to improve and develop ICT in education ('*Onbegrensd Leren*'), and this module may become part of these activities in the future. Utrecht University is currently working on its ICT and education policy.*

***Tip:** Embed the module in the organization's policy and the University Teaching Qualification (BKO) program.*

The module was part of an e-learning project, which lasted nine months and was paid for by the Board of the University. Although the project will not be continued, the e-learning team will continue its activities with interested staff members within the faculties.



The module was integrated into the University Teaching Qualification program as an optional in-depth module. It suited the goals of the program and the vision it supported of the skills needed in teaching design and quality control. The university has not yet established its policy on applying TPACK in course design, but it is clearly moving towards acknowledging the need for educational technology in teaching and in professional development policy.

***Tip:** Include activities (assignments) in which lecturers improve their TPACK in the professional development program, e.g. by redesigning specific assignments for students that integrate ICT, or by engaging in discussions of redesigned learning activities for students. This will improve the quality of teaching in general.*

***Tip:** Integrating the MARCH^{ET} professional development module into an innovation project focusing on ICT-enhanced teaching and learning can give participants just-in-time pedagogical and technological support. In this situation, the whole project team can work on achieving better quality innovation and thus more success. This can motivate university lecturers to continue learning and to pursue lifelong professional development in their work.*


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Part Two

Dimensions of implementing TPACK course redesign modules

Data collection

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1. Introduction

It is one thing to develop a module for professional development according to TPACK, but to ensure that lecturers will actually *attend* the module is quite another. More is needed than simply distributing a flyer or making some downloadable files available. How you go about this depends on the context in which the module is being organized. Although working online offers some advantages over traditional face-to-face education, the distance inherent in online working shares some of the disadvantages of greater personal freedom: a watered-down sense of 'presence,' and a limited form of communication (Van der Pol, Admiraal & Simons, 2006).

Based on both existing theory and our extensive experience implementing online modules at the local level, we have identified five crucial domains that must be taken into account when organizing a successful distance-learning module (Figure 2.1).

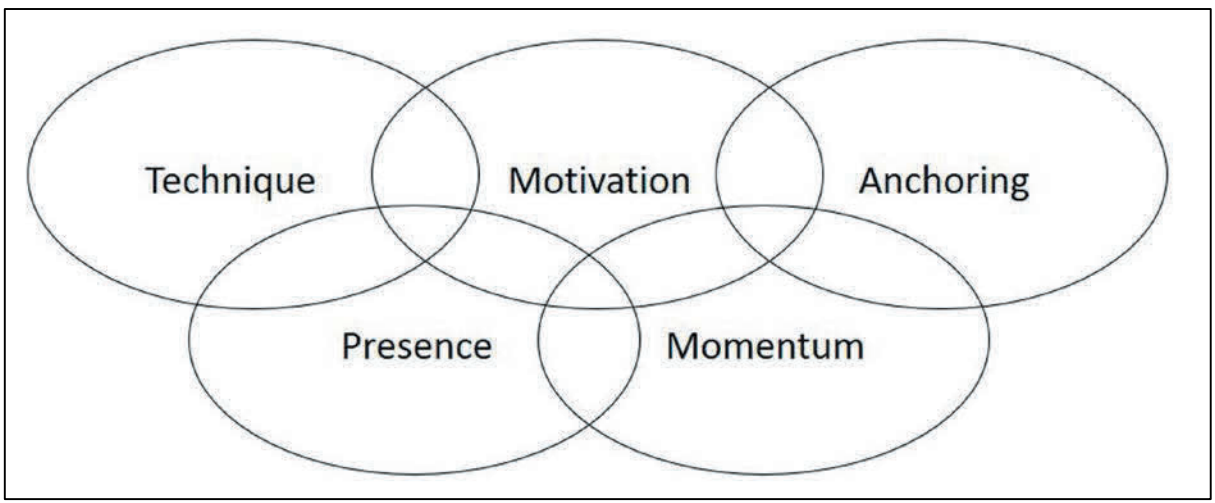

Figure 2.1: Crucial domains for successful distance learning

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First of all, it is crucial to ensure that all the technology used in the professional development module is available and in perfect working order. Technological hiccups will be very demotivating. Second, the participants' motivation at the start is crucial. Motivation can drop quickly during the module if lecturers have to juggle other, more demanding priorities. Make sure that their motivation is as high as possible at the start. This will also largely determine how actively participants engage in individual and collaborative assignments. Third, it is useful to integrate the module into its organizational context as much as possible. The participants will be more committed and the 'distance' smaller when the online module is more closely tied to the local context. Tailoring course contents to the participants' own practical working conditions increases the effectiveness of their final redesign (see Part Three).

Next, it is crucial to establish 'presence' in the online module. As described by Garrison, Anderson, and Archer (2000), a community of inquiry (or COI) needs to be established for successful online inquiry or discovery learning, composed of the module's participants and moderators. A COI cannot be established by offering only cognitive-oriented content and support, but depends on presence. Presence can be divided into three interrelated forms: (a) cognitive, (b) teaching, and (c) social presence. These three forms need to be incorporated into both the design of the module and its execution. Social presence is related to creating momentum, the last of the five domains that go into making a successful module with a distance learning component. Keeping the momentum going is crucial to ensuring participants' sustained involvement and to keeping the module at the foreground of their awareness.

Below is brief overview of the three forms of 'presence' mentioned above (Garrison, Anderson, and Archer, 2001).

- **Cognitive presence** means that the group of participants constructs meaning together through sustained communication. A proper course design stimulates this process.
- Thanks to **teaching presence**, the content and the assignments of the module are actively, deeply and meaningfully processed. It is important to note that teaching presence, which is established during a module by guidance, evaluation and feedback, needs to be anchored in the educational design of the module. The more the participants in professional development modules (in our case higher education lecturers) meaningfully and actively (re)construct the

meaning of teaching through active and discovery learning, the more their own learning process will focus on designing learning activities for their own students beforehand, in line with the idea that teaching is a design science (Laurillard, 2012).

- The third presence, the **social presence**, is about the participants' ability to identify with the group of participants (the 'community'), to communicate within the group and to develop inter-personal relationships with one another (Garrison, 2010). Social presence is especially important when it comes to countering the distance-learning effects of online education. It helps participants remain committed to the course and to one another and stay 'on track.'

For data collection purposes, we have elaborated the five domains (Figure 2.1) that are relevant for the successful implementation of online and blended modules into ten more specific dimensions of implementation.

2. Dimensions of Implementation

The MARCH^{ET} project (MARCH^{ET}, 2009-2011, Rienties et al., 2013) concerned the development of four *TPACK course redesign professional development modules*: 'Collaborative knowledge-building,' 'Web 2.0 educational applications,' 'Measuring knowledge and understanding,' and 'Supervising students in distance learning.' You will find more about these course designs in Part Three of this book.

As mentioned before, the modules were organized by five Dutch institutions for higher education during the MARCH^{ET} project. The modules were offered entirely online, and lecturers from different institutions worked together on a single online module. After the project was finished, each of the partner institutions implemented the modules at their own local level. However, although they used the same teaching materials and the same products of the project in which they had collaborated, kept the same basic instructional design and had modules based on the same TPACK ideas described in Part Three of this book, each institution also adapted the modules to suit their own context. All institutions chose a blended learning approach; both online and offline methods were combined.

Their experiences were collected for the purpose of determining what an organization of higher education needs to do and know in order to successfully implement TPACK into a professional development program for lecturers. Data collection took the form of a questionnaire with twelve open questions in order to ensure uniform and comparable information about the implementation. The information collected concerned the process of implementing the *TPACK course redesign professional development modules* at the institutional level, and the data was analyzed based on existing knowledge about e-learning and blended learning.

As a result of this analysis, four elements addressed in the questionnaire were clustered into groups. Clustering made it possible to identify ten specific dimensions of TPACK implementation in higher education, clarifying the domains for successful distance learning.

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Domains for successful distance learning with dimensions of implementation

Technique

1. Tools & Technology

Motivation

2. Participants & Recruitment
3. Goals & Expectations

Anchoring

4. Integration into the Organizational Context
5. Policy

Presence

6. Content & Assignments
7. Learning Process & Moderation
8. Social Bonding

Momentum

9. Planning & Timing Module
10. Degree of 'Blendedness'

It is important to note that the five domains responsible for the success of an online module partially overlap (see Figure 2.1) and that they are closely interrelated. For instance, 'motivation' is determined by the presence and the momentum created during the module. In addition, the parameters identified within one dimension can also influence other dimensions. For example, moderation by the module's

moderator not only creates ‘presence’ but also ‘momentum.’ The participants’ personalities, important for the ‘motivation’ dimension, influence their degree of social bonding in the ‘presence’ domain. In spite of these interrelations, the division into five main domains and ten dimensions can help us understand and handle the implementation of TPACK in the professional development of university lecturers.

The dimensions and the good practices linked to each dimension are presented in Part One of this cookbook as recipes for implementing TPACK. The recipes (and therefore the dimensions) are organized in chronological order of implementation. This brings them closer to educational practice and supports the main aim: to distribute recipes for the successful implementation of TPACK in higher education and to inspire lecturers to ‘try out the recipes.’

These ten specific dimensions define the influences on participants’ commitment. They are aligned with the overall aim of successfully completing the *TPACK course redesign professional development modules.* Taking these ten dimensions into account, institutions of higher education can organize a successful professional development program about technology-enhanced teaching and ensure that the participants can implement TPACK in their own teaching practice in order to improve the quality of university technology-enhanced teaching and learning.


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Part Three

TPACK course redesign professional development modules

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1. Introduction

What do lecturers need to know about technology-enhanced teaching and learning? And how do they acquire these knowledge and skills? There are many courses that tackle this question, but unfortunately not all of them are successful. To create an effective learning activity, which is a basic idea throughout this book, the designer has to find the best match between the content, the pedagogical approach and the technology. The following pages explain the theoretical background in more detail.

In general, lecturers at research universities have little or no formal teacher training. In some countries, university teaching staff undergo a short teacher training course, and lecturers sometimes need to obtain a teaching certificate. That is the case in the Netherlands, where the certificate is known as a *Basis Kwalificatie Onderwijs* or BKO. The course is often divided into modules or individual workshops focusing on lecturer's skills, such as lecturing, setting learning targets, or designing the assessments or test items. But what does a lecturer need to know specifically about designing courses in which educational technology is used, and which skills are needed to facilitate e-learning?

It is a real challenge to find a motivating way to teach professionals such as university lecturers how to give and design courses. Many previous courses aimed at training university staff in using technology in teaching and learning were not successful and had little or no impact on their actual teaching practice (Stes et al., 2010; Lawless & Pellegrino, 2007; Alvarez et al., 2009). The real question is thus how to design professional development modules so that they not only please the participants but also improve their teaching practice and lead to their students learning more and learning better.

University lecturers attend professional development modules within the context of their working environment, where they usually teach, do research and also fulfill other duties related to education, research or management. Lecturers who attend professional development modules about teaching are eager to gain knowledge that is directly relevant to their current teaching practice. If the module fails to meet this expectation, they will probably not attend or they will soon drop out. This is very

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different to students, who are learning for their 'future career.' This is something that should be taken into account when designing modules for lecturers.

Educational technology is developing at a very rapid pace, and new tools appear on the market every day. Learning how to operate buttons in different ICT tools is not really efficient in the long run. Of course, lecturers do need some specific knowledge about the tool they are using in their teaching, but they need to learn it on the spot, when they need it, and in a manner suited to the teaching approach or pedagogy and the subject matter that their students have to learn. In other words, designing technology-enhanced learning also involves being flexible and becoming a lifelong learner.

Motivated by all these challenges, we developed four modules in the MARCH^{ET} project (2009-2011) that give lecturers in higher education access to knowledge and skills related to the (re)design of technology-enhanced courses:

- 'Collaborative knowledge-building'
- 'Web 2.0 educational applications'
- 'Measuring knowledge and understanding'
- 'Supervising students in distance learning'

The materials of the four MARCH^{ET} modules, such as the assignments and the study guides, can be downloaded free of charge from www.onderwijsontwerpenmetict.nl (click on 'Modules' in the bar at the top of the page).

The four modules have the same course design. It is based on the TPACK model and in line with several educational theoretical principles. As mentioned in the Introduction, TPACK stands for Technological Pedagogical Content Knowledge model, developed by Mishra and Koehler (2006). That is why we refer to the modules as *TPACK course redesign professional development modules.* From an educational point of view, the modules can be seen as a single group and as a proof of concept for introducing

university lecturers to TPACK. During the MARCH^{ET} project, we measured the success of the four modules and identified a significant positive effect on the participants and their teaching practice (Rienties, 2013a and 2013b).

Before we explain the course design of the TPACK modules in-depth, let us first look at the philosophy behind them. Our explanation will clarify how these modules are special and how they differ from 'traditional' professional development modules and from the modules intended for students in regular study programs.

The philosophy of the MARCH^{ET} modules is based on three pillars: the paradigm shift, the principle of anchoring learning in one's own teaching (working) practice, and the 'teach as you preach' principle.

1.1 The paradigm shift

The *TPACK course (re)design professional development modules* developed in the MARCH^{ET} project share a constructivist view in which learning is the active and meaningful construction of knowledge by the learner. The modules are in line with the idea that teaching is a design science (Laurillard, 2012). In order to design valuable learning experiences for students, the module participants, all university lecturers, learn how to use their technological, pedagogical and content knowledge in an integrated, or TPACK, way. They learn about course design by designing rich technology-enhanced learning activities for their own teaching practice, and they learn how to make the expected learning outcomes explicit enough to align them with learning processes and assessment (Biggs, 2007).

To design active and self-discovery learning by students, lecturers must swap their traditional role in which they simply explain knowledge for the more complex role of an 'architect' who creates learning opportunities for students, so that they are able to construct their own knowledge to a level of deep understanding. The participants in the modules reflect on the success of the course design that they have applied in their own teaching practice. In this context, the traditional belief that a university lecturer should transfer knowledge by giving lectures is no longer satisfactory. They need to shift from believing in the 'transfer of knowledge' to believing in 'facilitating knowledge construction by students'.

1.2 Anchoring learning in one's own teaching practice

There are different ways to help lecturers take a more professional approach to course design. Offering a course on course design theory is not the most effective way to teach lecturers how to design a course. This is not only because lecturers generally work under a lot of time pressure and so will not be able to invest enough time in a thorough revision of their own teaching after completing the course, but also because they will on their own when tackling their most difficult assignment: to translate and to apply the knowledge that they have just acquired in a new context, in their own teaching practice.

The best way to ensure that participants apply the knowledge they have just acquired directly in their teaching practice is to make the module's learning activities part of their teaching practice. The participants start the module by working on their own questions and problems and for their own reasons (in line with De Galan, 2003) and finish it by implementing the course (re)design in their teaching practice (in line with Mishra & Koehler, 2006).

The advantages to anchoring the module in everyday teaching practice are huge. Applying, translating and transforming theory into a concrete and detailed redesign for the participant's own course ensures that he or she has mastered the competence of course (re)design and understands the necessary theory behind it. Having lecturers develop a TPACK-proof course (re)design ensures that they have integrated technological, pedagogical and content knowledge while developing learning activities for their own students. Last but not least, achieving a concrete result in their teaching practice gives the participants the feeling that the time invested in the module was well spent.

Last but not least, anchoring participants' learning in their own teaching practice ensures that their teaching practice will change/improve. Lectures appreciate this, it improves the quality of their students' learning and it benefits the educational institution as a whole.

1.3 'Teach as you preach' principle

Many lecturers choose as their preferred teaching method the method applied by a teacher whom they appreciated when they themselves were students. The definition of 'good teaching' is most convincing when one experiences it first-hand. To be able to design teaching in line with modern educational theory on teaching and learning, and to integrate technology into teaching, the lecturer has to embrace the new paradigm. This will not happen if we do nothing more than explain theoretical models according to traditional teaching methods. The professional development module is meant to create learning opportunities for the participants that make the above possible. The module must be designed in line with the new paradigm of active learning, and the course design for the professional development module must be 'TPACK-proof' in itself. In keeping with the principle 'teach as you preach,' the participating lecturers will have rich learning experiences and experience the new approach first-hand. This gives them enough opportunity to gain worthwhile and relevant knowledge and skills and apply these directly in their own teaching practice.

2. Theoretical Foundations

The four *TPACK course (re)design professional development modules* developed in the MARCH^{ET} project are based on five theoretical foundations. Understanding these theoretical foundations helps us comprehend the modules' course design and the considerations that go into choosing it. The first theoretical foundation is 'social constructivism,' which is an approach to good teaching and learning. The second theoretical foundation is the pedagogical design of the modules, which is based on an old but still very useful 'pedagogical model' developed by Van Gelder (1970), referred to in Dutch as the *didactische analyse model* (DA model). The third theoretical foundation is the revised Bloom's Taxonomy (Anderson & Krathwohl, 2001) for defining learning outcomes (often called 'learning objectives'). The fourth theoretical foundation is Biggs 'constructive alignment' of learning outcomes, the learning process and assessments (Biggs, 2003), a widely accepted principle of pedagogically sound course design. The fifth and final foundation is the 'action research' approach. It is used as a reflection method by the participants in their own teaching practice.

2.1 Social constructivism

Social constructivism is a sociological theory of knowledge and learning in which groups co-construct knowledge for one another in a social context (A.S. Palincsar, 1998). Learning is an active, constructive, social, cumulative and goal-directed process. This also implies an emphasis on activating pre-knowledge.

Impact on instructional design of MARCH^{ET} TPACK course redesign modules

The modules create opportunities for participants to work together while sharing their beliefs and ideas about teaching and learning. The modules encourage the participants to give one another peer feedback on their course (re)design.

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2.2 The DA model

The DA model can be used as a basic model for the design of any teaching and learning situation. DA stands for *Didactische Analyse*, which in English means 'Pedagogical Analysis' (Figure 3.1). The DA model was formulated in the 1960s and is regarded as a basic approach in teaching design in the Netherlands (Van Gelder, 1970). Two components in this model play a highly relevant role in effective course design:

1. Formulate learning objectives, and
2. Identify the important characteristics of the starting situation; in other words, define the pre-knowledge of the learners.

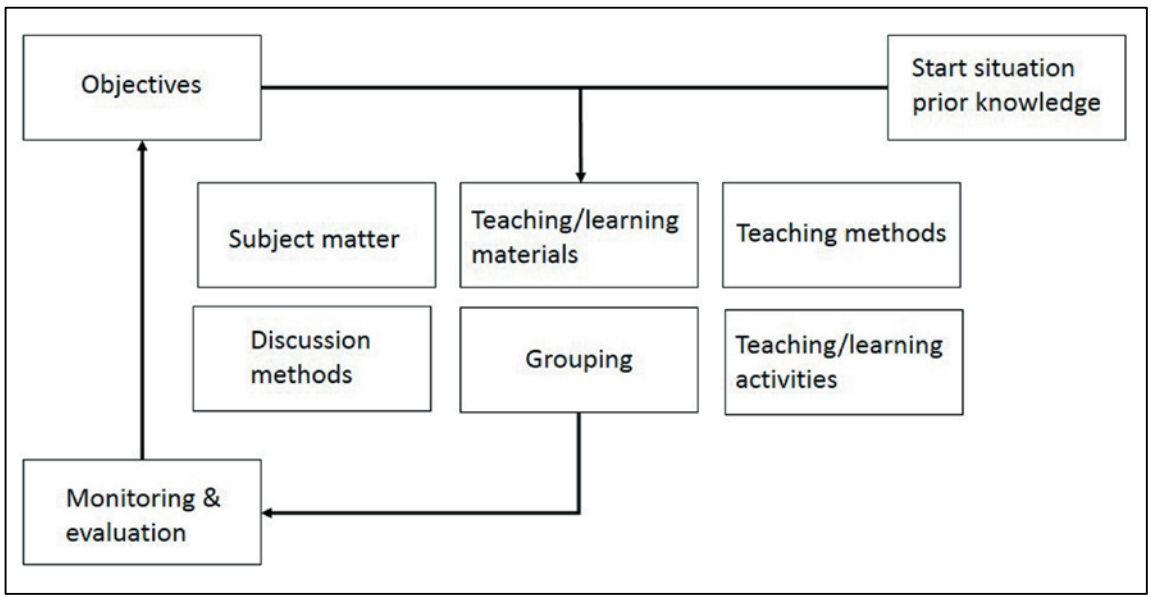

Figure 3.1. DA model by Van Gelder (1970)

These two elements are the input for the process of identifying the content, the teaching methods and the learning activities. From here, a teacher can identify and develop proper materials for the course. After the actual teaching – in other words, after implementation of the teaching design in practice – there should be an evaluation in which the teacher mainly checks whether the learning objectives have been reached.

Impact on instructional design of MARCH^{ET} TPACK course redesign modules

The modules contain assignments that require the participants to describe their teaching situation (a 'problem') at the beginning and to redesign teaching in line with this model. By using this helpful model and its terminology, the participants can communicate about their course designs in a structured way and can better understand one another's course (re)designs. This gives them the necessary basis for their arguments when giving one another feedback.

2.3 Bloom's Taxonomy

Bloom's Taxonomy (Revised Bloom's Taxonomy in Anderson & Krathwohl, 2001) is a system of classification for learning objectives. Bloom's Taxonomy divides educational objectives into three 'domains': affective, psychomotor, and cognitive. Learning at higher levels depends on having attained prerequisite knowledge and skills at lower levels. In the cognitive domain, the taxonomy has six levels. From 'low' to 'high,' these cognitive process levels are: remember, understand, apply, analyze, evaluate, and create. The knowledge increases in complexity from factual, conceptual, and procedural to the most complex metacognitive knowledge (see Figure 3.2).

Impact on instructional design of MARCH^{ET} TPACK course redesign modules

The learners get acquainted with Bloom's Taxonomy of learning outcomes and with a framework within which they create a lesson plan for their own teaching practice. The lecturers receive simple instructions for defining and formulating learning outcomes, using active verbs and noun phrases. This helps them make the learning outcomes as explicit as possible and link them closely to the course content. In the module learning process, they give and receive peer feedback and comments from the moderator.

2.4 Constructive Alignment

Constructive Alignment (Biggs, 2003) expands on an idea that is also an important part of the above-mentioned DA model: the teacher should deliberately align the planned learning activities, the assessment, and the expected learning outcomes (goals). By doing this, the teacher makes a conscious effort to provide the learner with clearly specified goals, well-designed learning activities that are appropriate for the task they are given, and well-designed assessment criteria for giving feedback to the learner. The assessment tests to what extent the expected learning outcomes have been achieved by the learner (see Figure 3.3).

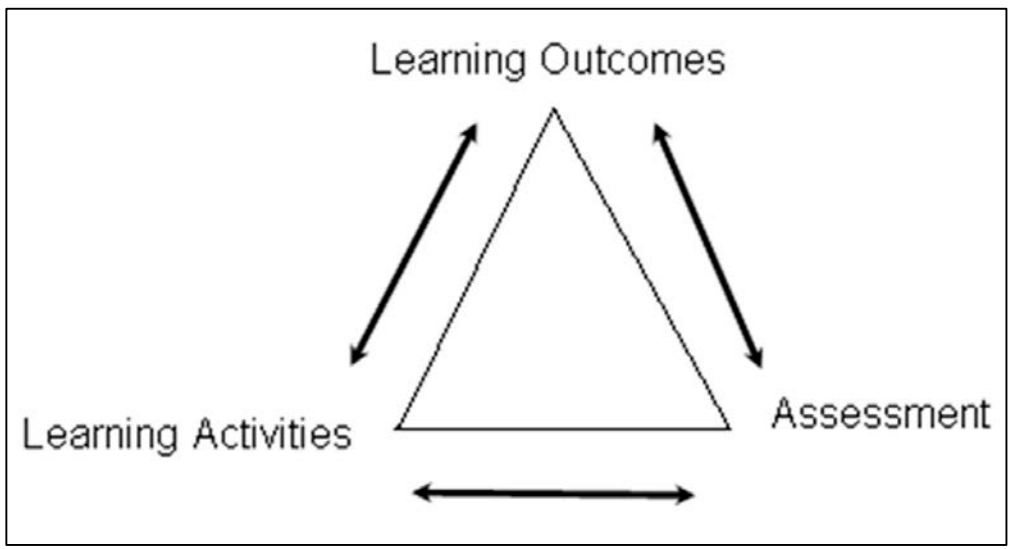

Figure 3.3 Constructive Alignment triangle (Biggs, 2003)

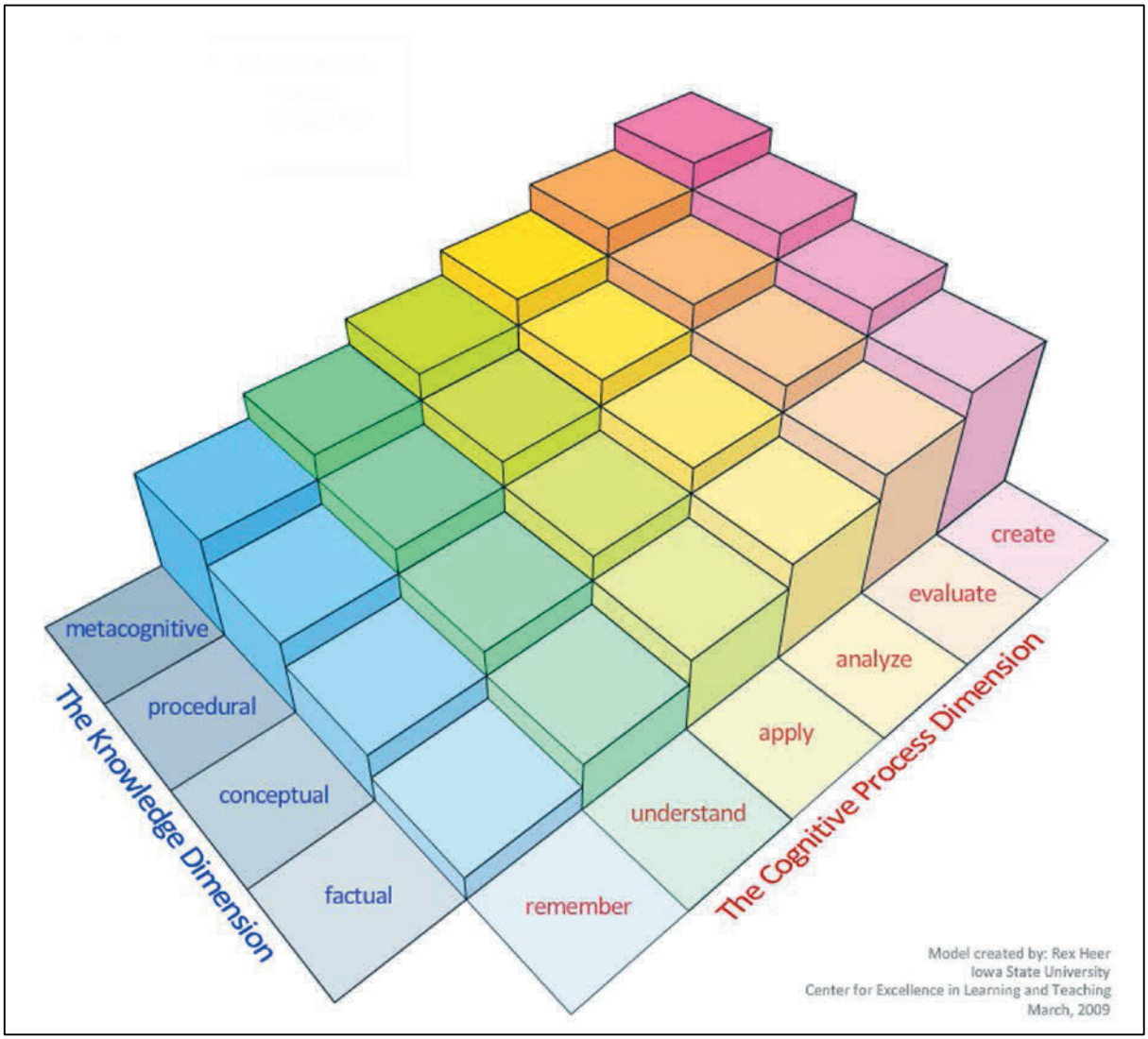

Figure 3.2 Revised Bloom's Taxonomy (Anderson & Krathwohl, 2001), model created by R. Heer, 2009, Iowa State University.

Impact on instructional design of MARCH^{ET} TPACK course redesign module

Each module, as well as each of the assignments within a module, has clearly stated learning outcomes that are communicated to the participants in the study guide. The participants work on individual or group assignments. For example, they participate in the group meetings and discuss collaborative learning, design learning activities individually for their own teaching course, draw up their own teaching plan and give one another feedback. In doing these things, the participants create various documents that can be seen as evidence when evaluating their knowledge and teaching skills. This allows the module's moderator to evaluate the extent to which the participants have achieved the expected learning outcomes and to give them feedback on it. When a participant has finished all the assignments successfully, he or she is awarded a certificate.

There is therefore a deliberate alignment between the planned learning activities, the assessments, and the expected learning outcomes in the module. As they work through the assignments, the participants deliberately align the learning outcomes, learning activities and assessment of the courses that they are (re)designing. This creates a kind of 'Droste effect' (see illustration): during the module, lecturers gain first-hand experience of teaching methods that they can, in turn, implement in their own teaching practice. The module is a miniature version of the intended end result, similar to the woman on the famous box of Dutch cacao (Figure 3.4).

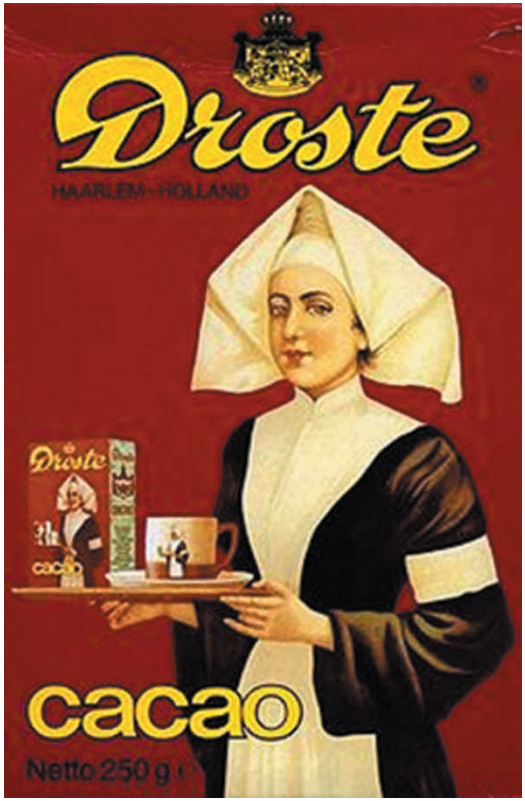

Figure 3.4 'Droste effect' on a box of Droste cacao

2.5 Action research

Action research is a 'reflective process of progressive problem solving, led by individuals working with others in teams or as part of a "community of practice," to improve the ways of how to address issues and solve problems' (Elliott, 1991). Action research is conducted simply by undertaking action, i.e. introducing a change in teaching in controlled circumstances. After introducing a change, its effect must be evaluated. Action research can be seen as a cycle of planning teaching, acting (executing the plan), observing the effect on teaching practice, and reflecting on it. This should result in an adjustment of the course design and a new iteration of the *action – evaluation – reflection - adjustment* cycle.

Impact on instructional design of MARCH^{ET} TPACK course redesign modules

The module participants are asked to redesign their lessons by designing proper learning activities and suitable tools for assessing them. They execute their design in their own teaching practice. Based on their own observations, the students' impressions and their learning results, the lecturers can decide whether or not to fine-tune their designs. In the *TPACK course redesign professional development modules*, the participants are encouraged to continue fine-tuning the teaching design after completing the module, as well as to reflect on it. They are encouraged to elaborate on their findings and share them with their colleagues.

3. Pedagogical Analysis

This chapter is about the pedagogical aspects of professional development modules in which university lecturers learn how to design technology-enhanced teaching. We address the particular knowledge and skills that a lecturer in higher education requires in order to design such courses. We use the *TPACK course redesign professional development modules* as an example for discussing the course design; in our case, the modules worked well as professional development courses for university lecturers (Rienties et al., 2013a, 2013b). We also show why it is so important to integrate three types of knowledge – technological, pedagogical and content knowledge – to produce a successful course design.

This chapter is divided into three parts. It begins with a conceptual analysis of the subject and a discussion of the TPACK model showing why the integration of pedagogical, content and technological knowledge is so important for a sound course design. The chapter then lists the learning outcomes of a *TPACK course redesign professional development module* developed in the MARCH^{ET} project in order to show which knowledge and skills a lecturer needs to design sound courses in which ICT is used. Finally, the chapter presents a generic instructional design for the *TPACK course redesign professional development modules* to illustrate how a module might be in practice.

3.1. Conceptual analysis of the subject

The conceptual analysis of the subject is based on Technological Pedagogical Content Knowledge model or TPACK model. This model, developed by Mishra and Koehler in 2006, explains the relationship between the different types of knowledge needed to teach effectively using technology. In a comprehensive survey of the literature, Voogd, Fisser et al. (2012) systematically reviewed theoretical and practical studies about TPACK.

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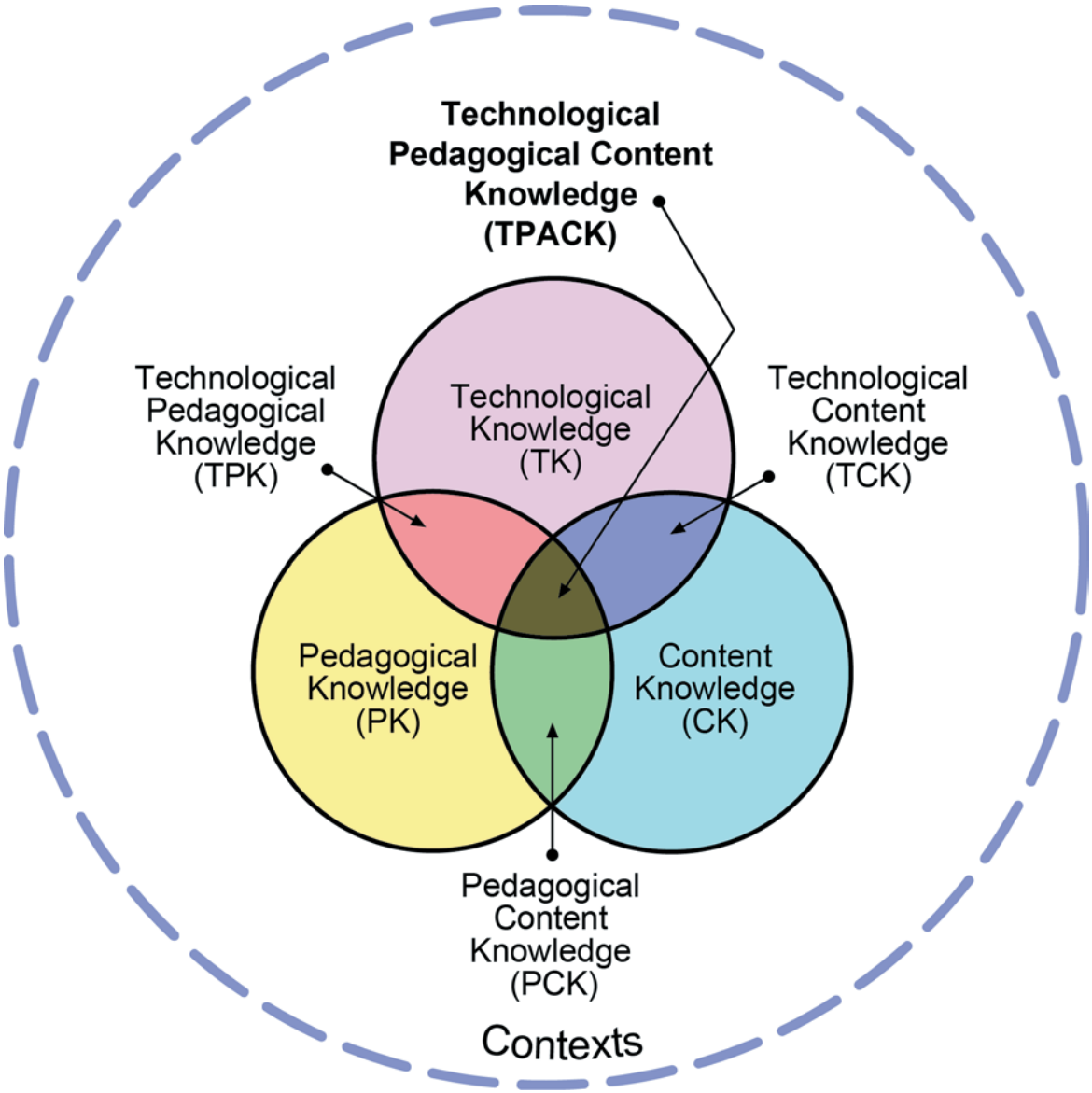

Figure 3.5 The TPACK model, taken from tpack.org (Mishra & Koehler, 2010; 2006)

The basic idea of the TPACK model (Figure 3.5) is the following: in order to teach effectively using technology, it is important to adjust the course content to the chosen technology and pedagogy so that the three will be mutually adapted and thus mutually reinforcing. Mishra and Koehler (2006) argue that teaching is most effective when content knowledge (CK), pedagogical knowledge (PK) and technological knowledge (TK) are used in an integrated TPCK way, while taking into account the contexts in which teaching takes place.

The 'pedagogical content knowledge' (PCK) interface in Figure 3.5 reveals the importance of ensuring that the pedagogical approach matches the respective content taught in the course. We can demonstrate the importance of this match with two examples: a psychobiology course and a chemistry course. The teaching goal of the psychobiology course on brain development was to let the students achieve a deep understanding of the long-term effects on the brain early in life. The lecturer had organized a discussion in which students talked about the research results described in the literature. Specifically, she let them make decisions about the relative importance of the observed effects on the brain. This allowed the students to arrive at a deep understanding of the concepts dealing with brain development. In the chemistry course on organic spectroscopy, the goal was to predict the molecular structure of unknown compounds using different spectroscopic methods. The lecturer applied a problem-based learning method. By solving the structure of unknown compounds using their spectra, the students constructed knowledge about how to apply different spectroscopic methods in chemical analysis practice.

The 'technological content knowledge' (TCK) interface shows the combined knowledge of the lecturer needed to use ICT tools in the most effective way for learning specific subject matter. For example, to learn about the long-term effects on the brain early in life, the students could access literature about the research in this field online. They could find MRI scans of mice brains in different phases of their lives. They could compare the results of different research methods and find answers to their own questions about the effects on brain development. The lecturer of the chemistry course chose a different ICT tool. The students studied the molecules using a chemistry drawing program. They were able to visualize changes in the spectrum when they altered the structure of the molecules slightly.

The ‘technological pedagogical knowledge’ (TPK) interface illustrates that the use of educational technology requires the lecturer to change his or her teaching methods. For example, if students have access to large quantity of data or information, or if they can use advanced computer applications, they can solve more complex and more realistic problems than when they only use pen and paper to work out simple calculations. Another example is the use of video. Pre-recorded knowledge clips or web lectures that students watch before a face-to-face meeting make it possible to use different active learning activities during the face-to-face meetings and to intensify learning and knowledge construction by students. This method is known as the ‘flipped classroom.’

The interface between the three sections, i.e. pedagogical, technological and content knowledge (TPCK) positioned in the middle of the TPACK model, represents the optimal level of knowledge integration for designing technology-enhanced teaching and learning. Armed with the knowledge and skills in this central area, lecturers can design TPACK-proof learning activities. Their design depends on the learning goals, the subject matter and the context of the course. This makes every course unique and turns every lecturer into a creative designer of challenging learning activities for students. For example, if the goal of the psychobiology Master’s course is that students will acquire a knowledge of ‘long-term effects on early brain development’ at the cognitive level of evaluation (according to Bloom’s Taxonomy), then an appropriate learning activity could be as follows. The students meet online in several small collaborative learning groups and prepare for the meetings as a group with their lecturer. They use online literature resources and construct a wiki in which they answer the questions in their assignment. Different collaborating groups treat the concepts dealing with brain development from different perspectives. During the plenary meeting, the lecturer organizes a discussion between the different groups, with each group presenting its arguments, defending pros and cons from different perspectives, and formulating conclusions. This helps students construct a deep knowledge of the subject. This is just one of the possible teaching designs. Many other challenging teaching designs are imaginable, depending on the specific learning goals of the course and the lecturer’s creativity.

Using TPACK, lecturers can make relevant choices about the lesson content. The TPACK model clarifies the importance of integrating the lecturer's different areas of knowledge. The lecturer invests in finding appropriate teaching methods for his or her chosen content, considers reasons for selecting a specific learning technology tool for the chosen pedagogy and content, and uses these in an integrated and constructive way in order to help students construct their knowledge at the required cognitive level.

There is often an imbalance between the application of the three types of knowledge in actual teaching practice. Research shows that technological knowledge is often viewed as being separate from content and pedagogical knowledge (Kirschner, Beers, Boshuizen, & Gijselaers, 2008; Martens, Gulikers & Bastiaens, 2004; Mishra & Koehler, 2006), although content knowledge should in fact define which ICT tool will be used and which teaching method is best suited to it (Koehler & Mishra, 2005a, 2005b; Mishra & Koehler, 2006; Voogd, 2012).

To allow lecturers/designers to experience the importance of these views when deciding to use technology in teaching, they should first look at their own courses and identify what needs to be improved or which learning problem the students are encountering. The problems can be diverse. For example, the students may not be sufficiently motivated or involved, or the pass rate as a whole or for a specific exam question may be below par. The problem may also be a misconception that students have about a specific important concept. Based on the urgency of the specific problem learning situation, lecturers will consider what to improve and how to improve it in order to arrive at the expected learning outcomes. They will use their TPACK and redesign learning activities, which will facilitate knowledge construction by the students, instead of simply introducing an ICT tool in the course. This means that the lecturer's role in the course shifts from knowledge transfer to learning facilitation, and his or her beliefs move away from the traditional view of teaching as transferring knowledge.

Which knowledge and skills does a lecturer need to design pedagogically sound technology-enhanced teaching and learning? The *TPACK course redesign professional development modules* will be used here to illustrate the knowledge and skills that need to be addressed in the professional development of university lecturers in line with the TPACK model areas and their interfaces (Figure 3.5). The learning

process of the participants in these modules took place in a 'hands on' educational setting. The participants improved their technological, pedagogical and content knowledge (TPACK) by applying it in their own teaching design, discussing it with the group, and reflecting on the effects of the course redesign in their own teaching practice.

The knowledge and skills developed by participants who attend the TPACK modules can be divided into generic skills in the TPACK domains of pedagogy (P), technology (T) and content (C) (Figure 3.5), and the knowledge and skills located in the TPACK interfaces.

3.1.1 Generic skills in areas P, C and T

All three groups of generic knowledge and skills located in the P, T and C areas of the TPACK model (Figure 3.5) were addressed in the four *TPACK course redesign professional development modules*. The area covering pedagogical knowledge and skills (P) was the most extensive.

- *Generic pedagogical knowledge and skills (P)*:
  - ✓ Design of teaching
  - ✓ Support and supervision of students
  - ✓ Quality control of teaching redesign using action research principles
  - ✓ Reflecting and reporting on one's own learning process

- *Generic technology knowledge and skills (T)*:
  Because ICT tools are constantly changing and new tools come on the market almost every day, learning how to use different tools was not one of the learning outcomes of the *TPACK course redesign professional development modules.* Instead, the participants focused on only one or at most two ICT tools. If necessary, specific technical support was available.

- *Generic content knowledge and skills (C)*:
  The participating lecturers used their own specific content knowledge and skills to make a TPACK-proof course redesign. The university lecturers participating in the modules were experts in their own fields. It was not necessary to cover this area in the professional development

module. It would also have been impossible for the moderator to provide content-related feedback to lecturers in so many different disciplines. When the participating lecturers worked in the same discipline, however, they could also give one another peer feedback on their content knowledge.

The success of the *TPACK course redesign professional development modules* depended on the participants acquiring the knowledge and skills needed to use an ICT tool that would allow their students to achieve specific learning goals. The module study guide indicated that some fundamental ICT-related knowledge and skills were a 'pre-requisite'.

3.1.2 Knowledge and skills at the TPACK interfaces

The knowledge and skills developed by the participants who attended the *TPACK course redesign professional development modules* were located on the three overlapping areas of the TPACK model: technological-pedagogical knowledge, pedagogical-content knowledge, technological-content knowledge and technological-pedagogical-content knowledge. To create a TPACK-proof course redesign, the lecturer needs to operate at the center of the TPACK model.

- *Technological Pedagogical Knowledge and skills (TPK)*
  In this area, the participants of the modules develop the knowledge and skills needed to support and facilitate specific pedagogical methods and activities when ICT tools are used:
  - ✓ Competence in choosing a proper tool to present teaching material.
  - ✓ Competence in choosing a proper tool to enhance learning by individual students (student-centered approach).
  - ✓ Competence in choosing a proper collaboration/communication tool to enhance learning in groups of students who are exploring content to achieve specific learning outcomes.
  - ✓ Knowledge and skill in providing a clear rationale for a chosen technology.
  - ✓ Ability to deal with the limitations of the technology or pedagogy applied.

- *Pedagogical Content Knowledge and skills (PCK)*
  PCK represents a deeper understanding of the subject matter, which any teacher needs in order to make ideas accessible to students and support them in constructing their own knowledge structure, to relate one idea to another, and to address misconceptions (Shulman, 1986, 1987). The following knowledge and skills are situated in this domain:
  - ✓ Preparing an instructional plan for learning a specific concept.
  - ✓ Selecting/developing teaching strategies that are appropriate for the specific subject domain in order to guide students' thinking and learning.
  - ✓ Recognizing individual differences in learning styles and selecting/developing appropriate teaching strategies for addressing them in order to improve individual students' learning of and motivation to learn a specific course concept.
  - ✓ Recognizing differences in the knowledge background of students and designing teaching strategies to cope with the problem of knowledge gaps.
  - ✓ Being aware of students' possible misconceptions and ability to develop strategies to address these misconceptions.
  - ✓ Being aware of students' different learning styles and cultural differences.

- *Technological Content Knowledge and skills (TCK)*
  The overlapping area of technological and content knowledge represents the necessary integration of two types of knowledge. The combination allows lecturers-designers to choose an appropriate computer tool that will help their students learn about a specific subject or concept. For example, a peer-feedback tool can be used to provide feedback on academic writing. The knowledge and skills in this area are:
  - ✓ Competence in choosing an appropriate ICT tool that students can use to learn about a specific concept.
  - ✓ Competence in using domain-specific scientific data (for example digital collections of paintings in art history courses or DNA sequences in biology courses) and information resources such as a digital library or domain-specific databases.

- ✓ Competence in choosing an appropriate computer program or ICT for learning within a specific research domain (e.g. software simulating natural science phenomena, diagnostic software in medicine, or specific software used in linguistics).

- *Technological Pedagogical Content Knowledge and skills (TPCK)*
  This domain consists of the knowledge and skills necessary to design and provide teaching in which the use of technology is educationally sound. This involves designing and providing teaching and facilitating learning activities in which the content (C) fits the teaching/learning strategy (P) and the technology (T), so that all three forms of knowledge work together to achieve learning outcomes and improve deep learning – TPCK:
  - ✓ Competence in facilitating deep learning of specific concepts at higher cognitive knowledge levels.
  - ✓ Competence in detecting misconceptions in students' content knowledge and addressing them in the teaching design.
  - ✓ Competence in facilitating online collaborative learning groups of students solving specific problems.
  - ✓ Competence in facilitating flexible learning in time and space according to students' personal goals.
  - ✓ Competence in facilitating learning according to different learning styles.
  - ✓ Competence in creating or facilitating real (and realistic) learning contexts, for example the scientific research context or the social context.
  - ✓ Competence in facilitating the development of students' scientific skills and critical thinking.

3.2 Learning outcomes

In this paragraph we list the learning outcomes of the four *TPACK course redesign professional development modules* developed in the MARCH^{ET} project. These modules covered the following topics: 'Collaborative knowledge-building,' 'Web 2.0 Applications,' 'Measuring knowledge and understanding,'

and ‘Supervising students in distance learning.’ The four modules serve to illustrate how we can improve lecturers’ awareness of the complex interplay between technology, pedagogy and content and ensure that they will apply that knowledge in their own teaching practice. All four modules were set up using the same design, following the TPACK principles. This allowed the lecturers to experience first-hand how TPACK-proof course design works in practice.

The main learning outcome for all four modules was: ‘To be able to use educational technology in teaching in an educationally relevant (TPACK) way.’ In addition to this general learning goal, we specified the following learning objectives for the four modules:

- Participants can explain the main theoretical concepts of the module’s subject (Bloom’s level: understand / conceptual knowledge).
- Participants can choose tools relevant to the subject of the *TPACK course redesign professional development module*, select the content to be taught in their own course, and match the pedagogy to the content and technology (TPACK) (Bloom’s level: understand / procedural knowledge).
- Participants can use at least two supervision tools (Bloom’s level: application / procedural knowledge).
- Participants can redesign the educational setting, using TPACK (Bloom’s level: synthesis, creation / conceptual knowledge, procedural knowledge).
- Participants can implement course (re)design in teaching practice (Bloom’s level: application / procedural knowledge).
- Participants can evaluate and reflect on their own redesign experiences in teaching practice – metacognition (Bloom’s level: evaluation / metacognitive knowledge).

To complement the general learning goals, every module also had specific learning objectives:

- *The module 'Collaborative knowledge-building'*
  - Participants can choose relevant technologies for collaborative learning within their own educational setting, based on educationally sound (TPACK) principles.
  - Participants can evaluate the added educational value or potential for collaborative learning of an ICT tool that facilitates communication, collaboration or data exchange.
  - Participants can design learning activities where students build knowledge online in a group setting.
  - Participants can reflect on own instructional design incorporating the ICT tool for collaborative learning.

- *The module 'Web 2.0 educational applications'*
  - Participants can choose relevant Web 2.0 educational applications within their own educational setting, based on educationally sound (TPACK) principles.
  - Participants can evaluate the added educational value of a Web 2.0 approach for a specific course (situation).
  - Participants can design learning activities where students use Web 2.0 tools.
  - Participants can reflect on their instructional design based on the Web 2.0 philosophy.

- *The module 'Measuring knowledge and understanding'*
  - Participants can use ICT tools for measuring knowledge and understanding in their own teaching environment, based on educationally sound (TPACK) principles.
  - Participants can evaluate the potential of an ICT testing tool for a specific course (situation).
  - Participants can design quality test questions for electronic testing.
  - Participants can evaluate the quality of test items and digital tests.

❖ *The module 'Supervising students in distance learning'*

- Participants can use ICT tools to support and supervise students in distance learning in their own teaching environment, based on educationally sound (TPACK) principles.
- Participants can evaluate the added educational value or potential for distance learning of an ICT tool that facilitates communication, collaboration or data exchange.
- Participants can design learning activities using synchronous or asynchronous communication principles.
- Participants can set up online learning environments and facilities for students to submit work for online assessment.
- Participants can design online feedback procedures and processes.
- Participants can provide online support and supervise individual students or small groups.
- Participants can reflect on their instructional design incorporating the ICT tool for distance learning.

Each participant works in the context of his or her own teaching practice and focuses on an area that requires improvement. In each case, this creates a new combination of technological, pedagogical and content knowledge.

3.3 Instructional design

All four *TPACK course redesign professional development modules* have the same instructional design. It is based on the OIEAR model (**O**rientation, imparting **I**nformation, **E**laboration/ **A**pplication, **R**eflection), whose educational phases describe the sequence of learning activities during a lesson, module or course in line with the teaching goal. The following sequence of learning activities was defined in our TPACK modules.

a. Orientation concerning the subject and tools

This phase consists of the first meeting and a brief period thereafter. Participants get acquainted and share information about their teaching situations or problems they are experiencing in the course they

teach. They are invited to use information provided in the module and familiarize themselves with the main subject of the module (such as collaborative knowledge-building) and the range of tools appropriate for the main subject. They share what they have learned about the materials offered in the module with the other participants on a discussion board. The moderator moderates the learning process.

b. Choosing a relevant tool

This can be seen as the elaboration phase of the module. Based on their own considerations, each participant selects the most suitable ICT tool for his or her educational setting. The group discusses whether the selection is TPACK-proof. These two phases are relatively brief.

c. Redesigning the educational setting

This is the application phase of the module. The teaching goal of this phase is for the participant to apply his or her knowledge of course design. Each participant redesigns all or part of a course that he or she is teaching and uses the selected ICT tool or tools in the redesign. During the redesigning process, the participants consider how best to align content, pedagogy and technology. Each participant gives and receives peer feedback on the course (re)design. Each participant makes a simple evaluation instrument to measure the effect of the redesign once it is implemented in practice. The moderator arranges the activities and is available to give final feedback on the course (re)design. This phase is the lengthiest part of the module.

d. Reflection on the module

Participants reflect on their experiences in the *TPACK course redesign professional development module* and the course redesign process and discuss both in the group. What was the situation at the start, what is the situation now, and what have they learned from it? This is the final step of the group process.

Because the participants' teaching tasks are scheduled in different periods, making collaboration impossible from this point on, the participants continue individually. The *TPACK course redesign professional development module* ends officially here and the participants who have successfully finished all

the assignments and delivered a TPACK-proof course redesign get a certificate of participation listing the knowledge and skills addressed in the module. As the heading indicates, this is the reflection phase.

The following two steps take place during and after the period, when the participants implement their teaching redesign in their own educational practice.

e. Implementation and evaluation

This phase is undertaken individual by each participant when he or she is teaching a course. The participants execute their redesigned lesson(s) in their teaching practice. Afterwards they use the evaluation instrument that they designed in phase c (see above) to evaluate the effects of the redesign on student learning and plan any necessary improvements. This process follows the action research cycle. The participants describe their results. In the OIEAR model, this is the application and reflection phase.

f. Presentation and sharing of results

After all (or nearly all) the participants of one *TPACK course redesign professional development module* have implemented their course redesign, it is very important to organize a meeting where they meet again and share their experiences. This is in fact a second reflection phase. For example, in the MARCH^{ET} project we organized a national conference. The participants in the *TPACK course redesign professional development modules* shared their teaching practice experiences and their evaluation results at the conference. The discussion was organized in the form of round tables. Besides the lecturers, one module moderator and one e-learning expert attended the round tables. This particular step in the instructional design sequence is hugely important because it facilitates reflection at the metacognitive level. The round tables addressed several questions for reflection at the metacognitive level:

- *With respect to the experience of the participant:* How did the new teaching design have the desired effect on student learning? If not, why not? What can be done to improve the design in order to achieve the desired effect (or make improve it)? Did the TPACK analysis offer an efficient means for producing the course (re)design?

- *With respect to the TPACK course redesign professional development module:* Did the module have the desired effect on the participants? If not, why not, and what can be done to improve the instructional design of the module? How TPACK-proof was the design?
- *With respect to the course efficiency:* How time-result efficient is the TPACK approach for a lecturer in higher education?

The modules (assignments and study guides in English) can be downloaded free of charge at www.onderwijsontwerpenmetict.nl, Modules download.

4. The Effect of Professional Development

There is a huge difference between learning as a 'regular' student and learning on the job while attending a professional development training program, module or workshop. 'Regular' students are learning for their 'future career,' and what they learn will be important after they graduate. They often have only a vague idea of where and how they will apply their new knowledge and skills. For lecturers who are professionalizing their teaching and learning skills to be applied immediately in their teaching practice, the situation is completely different. The design of a professional development program needs to take this into account. Whether the learner will make time for the learning process depends on how relevant the knowledge is for their practice: will they finish the course or will they drop out because of other, more pressing duties? Success in research is an extremely important career factor for lecturers at most research universities. On the other hand, lecturers are obliged to attend professional development programs, modules or workshops about teaching and learning at many institutions of higher education. Increasingly, they are required to have a teaching certificate before they can teach.

The literature reveals that professional development programs and courses have only a low impact on lecturers' teaching practice (Lawless & Pellegrino, 2007; Alvarez et al., 2009). In previous chapters, we have shown how to design successful professional development modules on technology-enhanced teaching and learning. Now we must answer the following questions: *Has the professional development program been effective?* And *how can this be determined?*

The evaluation of professional development courses is often limited to determining the participants' satisfaction with it. A survey at the end provides important information on whether the participants were satisfied with the content, the teaching methods, and the teachers/trainers; it reveals whether the atmosphere was comfortable and inspiring enough for learning. The second factor used to determine a course's success is the number of participants who passed and the number of drop-outs (the

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yield). It is important for the participants to be satisfied and for the yield of the course to be high, but these are still no guarantee that the course was indeed *effective*.

In line with the 'Kirkpatrick and Kirkpatrick' model for evaluating professional development training programs (2006), such courses should bring about an improvement, a positive change in the participants' working practices after the module is finished and they have returned to their daily work setting. In a large-scale survey of the effectiveness of training university lecturers in the use of ICT in teaching, only three out of 31 studies were found to have noted an improvement in the lecturers' teaching practice after they finished the course and returned to the classroom (Stes et al., 2010).

How can you ensure that lecturers will change their teaching practice after attending a professional development module? Based on fundamental research on learning and in line with a constructivist approach to education, we know that teachers who apply more student-focused teaching methods will be more likely to encourage their students to adopt a deep learning approach and are more likely to see conceptual changes in their students (Gow & Kember, 1993; Prosser & Trigwell, 1999). It is also important to emphasize that teachers can only successfully apply those teaching methods and approaches that correspond to their own views of good teaching. This highlights the importance of providing lecturers with rich learning experiences that will help them change their own beliefs about teaching from more teacher-centered to more students-centered.

The MARCH^{ET} project used the Teacher Beliefs and Intentions (TBI) instrument developed by Norton et al. (2005) as a pre-test and post-test of the participating lecturers' beliefs and intentions (Rienties et al., 2011, 2012, 2013). The Norton et al. (2005) instrument was adapted to the *TPACK course redesign modules* in the sense that the questions about media were replaced by more specific questions taken from a TPACK questionnaire. These questions measured the participants' perceptions of how they design and implement technology-enhanced learning in their teaching practice using competences situated at the interfaces of the TPACK model (see previous chapters).

The effect of the *TPACK course redesign professional development modules* was measured according to the 'Kirkpatrick and Kirkpatrick model' (2006) (Figure 3.6), in which the success of a module is measured at four levels: (1) Reaction, (2) Learning, (3) Behavior and (4) Results. According to 'Kirkpatrick and Kirkpatrick,' a professional training program is successful only when there is a significant result in the participant's working practice after he or she has completed the training program.

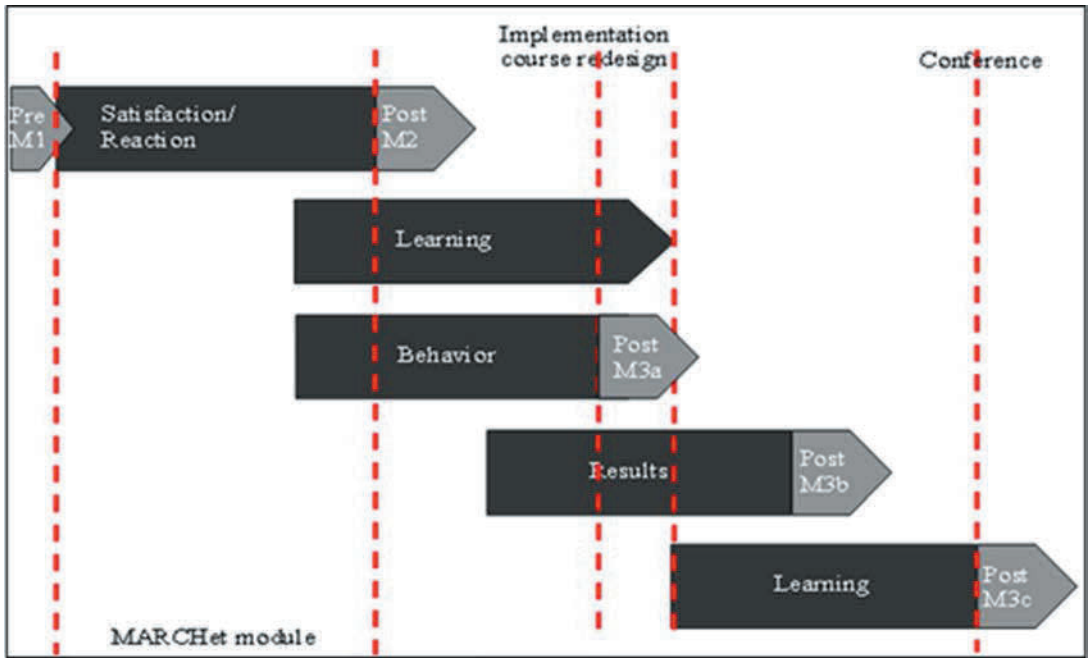

Figure 3.6 TPACK course redesign professional development modules (Rienties et al., 2013)

In the case of the *TPACK course redesign professional development modules* in the MARCH^{ET} project, measurement took place at five different points in time. The first was an online pre-test of Teacher Beliefs and Intentions (TBI) and a TPACK test (Pre M1, Figure 3.6). At the end of the module, participants took the same TBI and TPACK test as a post-test (Post M2, Figure 3.6). Contrary to expectations, Rienties et al. (2013) found no significant change in student-centered teacher beliefs as a whole, but

knowledge transmission intentions were significantly lower in the post-test than in the pre-test. This indicates that after finishing the module, participants were less convinced of the appropriateness of the knowledge transmission teaching style than before the start of the module. Postareff et al. (2007) warn that triggering changes in teachers' attitudes towards student-centered learning takes time. Rienties et al. (2013) found that professional development in line with the *TPACK course redesign professional development modules* resulted in a significant increase in all TPACK scores on the post-test. After training, the participants were more confident of their ability to integrate technology into their pedagogical design and discipline, and were putting this into practice (post-measurement PostM3a and PostM3c).

The change in behavior was measured again after some time had elapsed (Post M3a). This measurement was designed as a semi-structured interview and was conducted by phone with all the participants two months after they had finished the module. The delay was to guarantee that they had the chance to execute their course redesign in their own teaching practice. The semi-structured interviews revealed that most of the lecturers had implemented their TPACK course redesign in their teaching practice.

The final measurement took place during a conference at which participants from different modules shared experiences and the results (evaluation) of implementing the course redesign in their own teaching practice. Based on what they discussed during the conference, the lecturers appeared to have gained positive results in their teaching practice and had new plans to continue improving their TPACK course designs. This means that they were willing to go on with the action research cycle approach.

The educational vision of a lecturer's institution and the philosophy of the educational program in which he or she teaches determine how extensively the lecturer can amend his or her teaching practice after finishing the professional development program. The more the professional development program is integrated into the lecturer's teaching practice, the more extensive the change can be. In Part One of this book we discussed the dimensions that need to be addressed when aiming to incorporate a professional development program or module at an institution for higher education.

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