FaSMEd Position Paper

What makes an effective toolkit for teachers?

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Introduction

At the heart of FaSMEd is the design and construction of a toolkit for use by teachers and teacher educators. Our view is that we need to know what the research says about the design of toolkits so that this can inform our own design.

It is not always the case that educational designers draw on research to better understand what they should do and as McKenny and Visscher-Voerman (2013) say:

> " ....few researchers have strong conceptual understanding of the marriage between the design discipline and scientific research traditions. Rather, most have strong exposure to either (a) research methodologies or (b) instructional design methods, theories and/or practices."

The International Society for Design and Development in Education (ISDDE, n.d.) provides a coherent rationale for research into educational design. They state that

> "Around the world, separate design groups or individuals use more-or-less systematic, more-or-less research-based methods for the development of more-or-less imaginatively designed educational materials and processes."

They argue that classroom materials are highly important, and that their design and development 'surely deserves continuing attention'. We agree with this, and suggest that for FaSMEd, continuing attention might begin with an understanding of the research in the field.

A key aspect of the toolkit is the fact that it provides online professional development for teachers of mathematics and science. While we, as a consortium, are highly experienced in providing face to face professional development, perhaps we know less about online professional development. It seems to us that Dede et al (2008) may have a valuable point:

> "... although such programs are propagating rapidly and consuming substantial resources both fiscally and logistically, little is known about best practices for the design and implementation of these oTPD models."

Our suggestion is that this is another area that FaSMEd might explore in some detail, but is not addressed in this paper.

The paper begins by briefly exploring the notion of toolkits for teachers, giving examples of toolkits and toolkit-like resources already available. It then outlines something of what is already known about toolkit design.

The document is not intended as a final or complete representation of what FaSMEd knows or thinks about toolkits and their design, rather it should be seen as a starting point. Further development of our thinking can be found on the blog at http://fasmedaimssec.wordpress.com/the-design-of-a-toolkit/

Towards a definition of a toolkit for teachers and teacher educators

There are very many published resources, including those on paper (such as books) and those online, which are designed to support teachers in their classrooms. For example, there are lesson ideas, lesson plans, practical ideas, tips for teachers, professional development activities and research. The term 'toolkit' in relation to resources available to teachers is becoming increasingly popular but there does not seem to be any general agreement about what a 'toolkit' is.

The first section below provides some examples of resources that are called toolkits, and the following section looks at toolkit-like resources, which includes some produced by consortium partners.

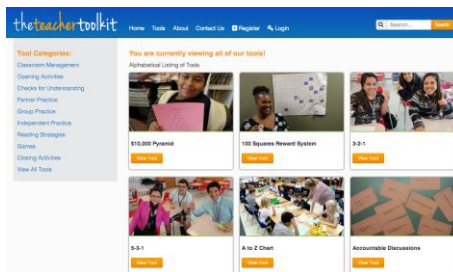From these we will develop a first definition of a toolkit.
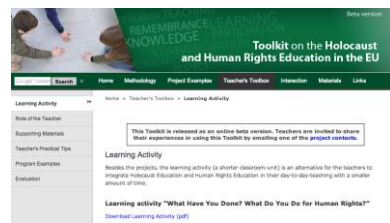
Examples of toolkits
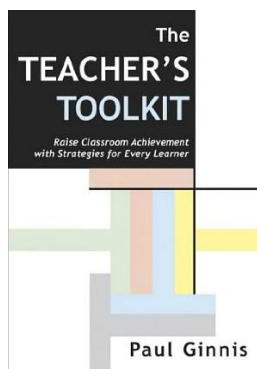
One of the earliest and best-known resources for teachers named as a toolkit may have been Paul Ginnis' book "The Teacher's Toolkit" (2002).

Ginnis' book relates to classroom strategies (in any subject area) as do many other toolkits.

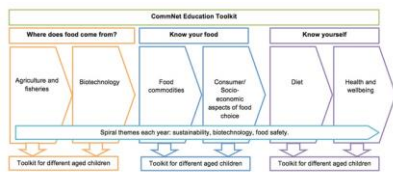For web-called toolkit' (Region 13 Educator Program, n.d.) provides a categorised under headings classroom management, understanding and games. example, the based toolkit 'the teachers Certification range of tools of, for example, checks for

A range of projects funded by the EU under FP7 have put together toolkits. For example, the Fundamental Rights Agency (FRA) and Yad Vashem developed a toolkit on the Holocaust and Human Rights Education in the EU(Fundamental Rights Agency & International School for Holocaust Studies, n.d.), which they describe as:

"a practical guide for teachers and educators who wish to develop teaching projects, by linking Holocaust and human rights. In addition, some examples of teaching projects and learning activities of Holocaust Education and Human Rights Education are provided in the Toolkit."

CommNet is a network of communication for EC-funded food-related research. It has produced, amongst other things, a toolkit for use by teachers (n.d.). They state:

> "Careful consideration has been placed on the learning needs of children and young people, as well as the concepts introduced. Educators are free to select the resources most suitable to the learning needs of their children and young people, supporting those with special educational needs. In addition, the resources are designed to allow the educator to select those most useful for their teaching -providing flexibility and choice."

Mascil is an EU consortium that promotes inquiry learning, related to the world of work, in mathematics and science. Some of FaSMEd's partners (Univeristy of Nottingham, HiST and Freudenthal Institute) are involved in Mascil and one partner was responsible for the design and content of a toolkit aimed at coordinators (or facilitators, multipliers) of professional development of teachers (Mascil, n.d.). This toolkit provides tools for use within professional development meetings supported by presentations, handouts, links to relevant videos or web sites and suggestions for next steps. Mascil explains:

> "The toolkit is designed to support these groups [of teachers] by providing a flexible resource to allow them to explore new and innovative teaching practices. It can be used in a totally flexible way that allows groups to work on aspects of teaching that they have prioritised or it can be used to provide a carefully planned training course."

Toolkit-like resources

This section provides examples of resources that could be seen as toolkits, but were not labeled by their authors as such. It includes some examples from outside the consortium but most are from within the consortium.

Partners from Nottingham University in the UK, HiST in Norway and the Fruedenthal Institute in the Netherlands were involved in the EU-funded project Primas. The overarching aim of Primas was to "effect change across Europe in the teaching and learning of mathematics and science by supporting teachers to develop inquiry-based learning pedagogies" and it produced teaching materials, professional development courses for teachers, support for teachers and support for professional development facilitators (PRIMAS-team, n.d.). The last of these is described by Primas as a set of modules, each of which "includes a CPD session guide and handouts for teachers, as well as sample classroom materials and suggested lesson plans." Within professional development, some or all the modules can be used, and in any order.

AIMSSEC in South Africa is producing a set of resources aimed at supporting teachers in running professional development workshops (n.d.). Although they have been developed to support teachers on the AIMSSEC courses, they will also be published for wider use. Each chapter is a six-page pdf document which includes a summary sheet, workshop activities for teachers, classroom activities for learners and key questions (which could be about the mathematics or extension questions for learners). The chapters are all stand-alone and can be used in any order.

The Edumatics project involved the Freudenthal Insititute, Università di Torino Ecole Normale Supérieure de Lyon and PH Freiburg. The project produced five professional development modules, related to integrating technology into the classroom (Edumatics, n.d.). The modules "offer a range of tasks and activities for both trainee and experienced teachers. These modules are also suitable for adaptation within professional development and teacher training courses." It is suggested that module 1 be attempted first, but other than that the modules are stand-alone and can be taken in any order.

Nottingham University devised and created over 100 'Formative Assessment Lessons' within MAP (mathematics assessment project) (University of Nottingham, n.d.). These lessons, written for an American audience and closely linked to the US Common Core State Standards, include classroom tasks for students plus any resources students might need such as card sets, PowerPoint presentations for teachers to use and extensive guidance for teachers. Each set of resources has been trialled in US classrooms and modified in the light of feedback from teachers and observers.

A definition of a toolkit for FaSMEd?

Drawing on the above, we now attempt to define what a FaSMEd toolkit might be: a toolkit for professional development would have the following features: It is:

- (probably) online;
- flexible, offering a range of tools which can generally be used in any order;
- practical and provides guidance for teachers.

Although a toolkit doesn't necessarily have to include activities that can be used in the classroom, the FaSMEd toolkit will include such activities.

Design decisions for toolkits

We are interested in the design decisions made by authors of toolkits and toolkit-like resources for use by teachers because these decisions could helpfully inform the decisions made by FaSMEd. Specifically, the focus of our enquiry is on resources intended to support teachers of mathematics and science by providing them with activities to be used in the classroom and with guidance to help them use the activities. Two key areas for design decisions naturally follow:

- The design of professional development; and
- The design of classroom activities.

Within both these areas, it is perhaps useful to consider the different aspects of design. For example, there are decisions related to the detailed design of individual activities or tasks intended for use in the classroom or the professional development setting ('tools') and there are also decisions related to the overall set of activities (which we can think of as a 'toolkit').

Burkhardt (2009) distinguishes between technical, tactical and strategic design. For him, technical design focuses on the design of individual elements and affects:

> *"the end users and their environment (students and the teacher in classrooms; teachers in professional development activities; the diverse students taking a test, and those who will score their responses)." (p. 2).*

It could be argued that Burkhardt's technical design relates to the construction of tools within a toolkit.

His tactical design "is focused on the overall internal structure of the product" (p. 2). He explains that tactical design is concerned with the overall coherence and underpinning principles of the tools, and for us, this seems to related to the construction of the toolkit.

Burkhardt's third aspect of design, strategic design, relates to the political contexts in which the toolkit will be used and is concerned with effective use of the product within the system it is intended to serve. It focuses on

> *"all the key communities involved who will affect decisions on the framework within which the users work – school leadership; school system leadership; politicians; parents; and various other professions, such as assessment designers and researchers." (p. 2)*

Whilst this aspect of design can be seen as crucially important, for FaSMEd it is less of a concern than the previous two aspects of design.

In the remainder of this section we provide examples of design principles gleaned from research literature and our initial research into toolkit design (interviews with some of the authors of toolkits and documentary analysis). Interestingly, these principles do not usually distinguish between the different aspects of design outlined above, but it may be that FaSMEd would find it useful to look at the principles through a 'Burkhardt lens'.

The design of professional development

All the consortium partners have expertise in in-service or pre-service teacher education. Each partner's design principles for professional development are probably well established. However, we are not confident that as a consortium we agree on these. This section provides some examples from the literature of such design principles, which may serve as a starting point for our discussion.

Karen Marrongelle and her colleagues (2013) generated a set of recommendations related to creating, sustaining and assessing professional development to support teachers of mathematics in aligning their teaching to the Common Core State Standards in Mathematics in the US. While not all these principles are relevant in the context of the FaSMEd toolkit, it is perhaps worth listing them all. We suggest that many can be adapted to FaSMEd's context, such as, for example, the first. This could be adapted so that the substance emphasized would be formative assessment.

The principles, taken directly from p.296 of the article, are outlined below.

1. Emphasize the Substance of CCSSM Professional Development:
2. Create and Adapt Materials for Use in Professional Development Aligned With CCSSM
3. Design CCSSM Professional Development Based on Features That Support Teacher Learning
4. Build Coherent Programs of Professional Development Aligned With the CCSSM
5. Prepare and Use Knowledgeable Facilitators for Professional Development Aligned With the CCSSM
6. Provide CCSSM Professional Development Tailored to Key Role Groups, in Addition to Teachers
7. Educate Stakeholders About the CCSSM: Members of the general public need to be apprised on how the CCSSM will impact instruction and learning in our nation's classrooms.
8. Continuously Assess CCSSM Professional Development: Professional development programs are regularly assessed to provide formative information for program improvement and revision and to establish the effectiveness of the programs.
9. Create CCSSM Professional Development Consortia

Whereas these principles relate to the strategic organization of professional development at a quasi-policy level, the report by the Researching Effective CPD in Mathematics Education (RECME) (Joubert, Back, DeGeest, Hirst, & Sutherland, 2009) project provides a set of recommendations more related to the content of professional development. The excerpt below is taken directly from the text of their final report (p. 6).

Developers and providers of CPD should:

- take into account the experience and expertise of teachers and build on these as opposed to adopting a 'deficit model'
- encourage teachers to try out new ideas in the classroom by giving them 'permission' to do so
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- build adequate time into the programme for teachers to try out new ideas and reflect on their learning
- consider the support, both intellectual and emotional, that teachers need in order to cope with adjusting to learning that challenges them intellectually and professionally
- include stimulating and challenging mathematical activities within the CPD programme
- include opportunities for teachers to develop knowledge about mathematics and ways of teaching mathematics within the CPD programme. This should include focusing on theoretical concepts when appropriate
- pay explicit attention to students' mathematical learning, acknowledge that this is not easy and build in time and opportunities within the CPD for teachers to develop their capabilities to recognise and talk about mathematical learning. This could involve the dissemination of relevant supporting research findings
- take into account a combination of factors, including teacher learning, change in teacher attitudes, the extent to which engagement in the CPD seems to evoke passion, changes in teachers' practice and changes in student learning within processes of self-evaluation
- be explicit about research underpinning the design of the CPD and the ways in which changes in classroom.

Korthagen et al (2006), draw on a set of programmes designed by themselves for initial teacher education to develop a set of principles about learning to teach. Again, while all these are not directly relevant to FaSMEd, some can be adapted. The principles, outlined below, are taken directly from their paper.

- Learning about teaching involves continuously conflicting and competing demands: ….. teacher preparation needs to focus on how to learn from experience and on how to build professional knowledge.
- Learning about teaching requires a view of knowledge as a subject to be created rather than as a created subject ….. teacher educators should actively create situations that elicit the wish for self-directed theory building in their students.
- Learning about teaching requires a shift in focus from the curriculum to the learner…The learning of student teachers is only meaningful and powerful when it is embedded in the experience of learning to teach. As teacher educators we need to be actively creating situations where this can occur and for it to be a natural part of teacher preparation.
- Learning about teaching is enhanced through (student) teacher research … actively researching their own practice can be a catalyst for student teachers to come to "see differently," to reframe a situation (Scho¨ n, 1983, 1987), and to thereby gain insights into how they might come to better understand that situation and act within it.
- Learning about teaching requires an emphasis on those learning to teach working closely with their peers…if, in teacher education, students get used to learning in collegial relationships, this will help to bridge the gap between what is done in teacher education and what those learning to teach actually need in their future practice.
- Learning about teaching requires meaningful relationships between schools, universities and student teachers … When we explore the question

- of what principles shape teacher education programs and practices in ways that are responsive to the expectations, needs and practices of teacher educators and student teachers, it is our conclusion that close cooperation is needed, not only in the sense of school–university partnerships, but also in three-way cooperation among teachers in schools, teacher educators in universities, and those who are learning to teach.
- Learning about teaching is enhanced when the teaching and learning approaches advocated in the program are modeled by the teacher educators in their own practice … Making the pedagogical reasoning for practice clear, explicit and understandable for student teachers is an important aspect of modeling teaching in teacher education.

In terms of materials designed to support teacher learning, Rebecca Schneider (2012) suggests that not enough is known about how to design materials to support teacher learning, explaining that the purpose of her work was to 'inform the design of teacher educative science materials' (p. 325). She concludes that materials designed to support teacher learning need to:

- Encourage teachers to think about and reflect on student thinking; (e.g. by including tasks that make the thinking of students visible to teachers)
- Provide help to create environments that support student learning;
- Engage teachers in planning and teaching;
- Develop pedagogical content knowledge; and
- Match the learning needs of teachers.

There are many other lists of recommendations and principles as well as many syntheses of these such as the one by Joubert and Sutherland (2009).

Although the FaSMEd partners have extensive experience in designing professional development (as stated above), we suggest that it is nevertheless important a) to refer again to the recommendations above and b) to be explicit about their own principles.

The design of classroom activities

Again, the FaSMEd partners have an excellent track record of designing activities for the classroom. However, again we could make explicit reference to the literature in order to develop our own principles. For example, a paper about designing learning environments to promote conceptual change in science, Vosnaidou et al (2001), provide some guiding principles in this respect. They suggest that:

- Learning environments should support active learning and guide the students towards the acquisition of self-regulated processes
- Schools should encourage children to work with other children and learn from them in ways that take into consideration their individual differences.
- Curricula should allow deep exploration and understanding of a few key concepts in one subject-matter area
- Designers should take into account the relational structure in which the concepts of a domain are acquired
- The design of instruction should consider how students see the physical world and provide support for students as they reorganize their existing knowledge
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- Learning environments should allow students to express their representations and beliefs, perhaps in group discussions
- Teachers should be aware of the differences between new information that is consistent with prior knowledge and new information that runs contrary to prior knowledge.
- Learning environments should provide motivation for students to put time and effort into persuading students to re-examine their preconceptions by exposing them to meaningful experiences.
- Cognitive conflict should be used carefully.
- Instruction should be model-based, rather than only linguistically and/or mathematically based.

Malcolm Swan (2008) suggests that design principles for learning experiences (tools in FaSMEd's case) should be drawn from an analysis of the purposes of the learning experience and the learning theories related to these purposes. He cautions that principles guide, rather than determine, the way a product/tool/learning experience is designed. For him, the following principles are key:

- building collaborative discussion into experiences
- focusing directly on significant conceptual obstacles
- building on the knowledge students already have
- creating tension and cognitive conflict that may be resolved through discussion
- using tasks that are 'accessible, extendable, encourage decision-making, creativity and higher order questioning'
- using multiple representations to create connections and
- using tasks that allow students to shift roles and explain and teach one another.

For Primas and Mascil, some of the principles underpinning the design of classroom activities were written into the Description of Work: for both Inquiry Learning was key, and for Mascil, connecting classroom learning to the World of Work was also important.

Other designers will have their own principles and FaSMEd will need to agree on the principles they adopt. Our view is that it is important to be explicit about such principles and to be clear about why and how they are used to guide the design of our toolkit.

Further design decisions

The section above relates to academic or scientific design decisions for classroom activities and professional development. It is perhaps obvious that such decisions need to be carefully considered when we are designing the FaSMEd tools and toolkit. However, we suggest that there are other design decisions that are also important and should be carefully considered. One key area might be the overall design of the toolkit (e.g. navigation and coherence) which would fall into Burkhardt's (2009) tactical design. A second might be the 'look and feel' of the toolkit which would include the visual design and the kind of language used. A crucial decision, however, is the publishing medium as this determines much of what is possible.

We are not yet in a position to refer in an informed way to the literature about these sorts of design decisions. However, we share some of our thinking and initial investigations. We begin by discussing the medium and go on to the overall design and then the look and feel of toolkits.

The medium

A first decision made by designers is the medium for the resources. Traditionally resources would have been paper-based, more recently frequently supported by digital media such as CD-ROMs and DVDs (for example, see the Standards Unit 'Improving Learning in Mathematics' or these resources files designed to support UK teachers in implementing the ICT curriculum). Increasingly, however, publishing the resources online has become a viable option (for example see the MaScIL toolkit.)

Advantages of paper-based published resources include the fact that they are usually subject to rigorous editorial control and that people tend to like having something physical to take away. Further print and paper is well-understood in terms of design (we know what fonts and colours work well and we know how to find our way through books). However, in comparison to on-line alternatives, the print medium tends to be more expensive and the time-frame for production is longer. Once printed, it cannot be changed.

For FaSMEd, the decision about the medium was implicit in the proposal as there is no money in the budget for producing materials printed on paper or CD/DVD. The toolkit will be online.

Overall (tactical) design

The overall design of a toolkit would fit into Burkhardt's 'tactical' design, which, as explained above, is guided by the underpinning principles of the toolkit and focuses on the internal structure and coherence of the product. We provide some examples, below, of the decisions made in terms of overall coherence and underpinning principles of various toolkits we have already described and go on to discuss FaSMEd's position.

For Mascil, some of the underpinning principles were made explicit (e.g. at the consortium meeting in Crete, December 2013, where it was stated that toolkit would a) build on what we already know about teacher learning b) be flexible as one size does not fit all, and c) adopt a 'professional learning community' approach which assumes that the community is committed to inquiry into their own practice.) Others were less explicit, such as that it should be visually attractive and easy to navigate.

In terms of coherence, the Mascil toolkit was designed around three 'domains', the first of which ('Ways of working') reflects principle c) above. The other two were derived from the overall project concept: that inquiry approaches in mathematics and science learning and connecting classroom learning to the world of work are desirable.

Paul Ginnis, author of 'The Teacher's Toolkit', told us in an email interview that, for his toolkit, tools need to enhance teaching and need to be useful in different contexts and should therefore not be subject-specific. He says that he believes some tools should be easy to use but others are more difficult and require training. He adds:

'It is important to have a range of tools, some more sophisticated than others to suit more skilled teachers.

I think that conceptual tools for teachers are ultimately more important than practical teaching techniques. What I mean is tools to help teachers to think about lesson or topic design. That's why my book has Section 1 given over to educational ideas and research.'

The authors of the 'FAB' toolkit are explicit about aspects of the tactical design of the toolkit, stating that it has taken into account not only the concepts introduced but also the learning needs of students. They say that the resources have been designed to allow the educator to choose those most useful for their teaching. The toolkit is divided into three main areas: Where does food come from?; Know your food; and Know yourself.

The FaSMEd consortium has begun to agree on the underpinning principles. Some are explicit: for example, it has been agreed that the toolkit should provide flexible, stand-alone tools that can be easily modified or adapted for the particular contexts of the teachers who use them. It has also been agreed that the toolkit must be visually attractive and easy to navigate.

The concept of FaSMEd determines to some extent what the actual tools might look like: they should support teachers in using formative assessment in their classrooms effectively. The description of work also suggests that the power of technology should be harnessed but that a range of technologies will be trialled. The consortium has therefore agreed that the toolkit itself will not be technology based but that consortium partners will use technology as appropriate in the versions of the toolkit they create for their country and local contexts.

In terms of the range and types of tools within the toolkit, there is not yet general agreement. For example, there is not yet clarity about what a 'tool' will look like, how many tools there should be, and what areas of mathematics and science they will address. As the toolkit will be developed over time and in conversation with teachers, many of these decisions will be crystallized over the course of the project.

Visual design and language used

An on-screen, on-line toolkit has a certain appearance in terms of both the visual design and the language used. It is common for the visual appearance of printed resources to be dictated, or at least influenced by, the publishers of the product. Designers of an online toolkit, however, tend to have more freedom and can experiment with visual designs. In the design of the Mascil toolkit, for example, the authors were constrained by the Mascil branding such as the logo and the colour scheme. However, they were free to choose the font, additional colours and layout.

We are aware that a wide research base into the visual design of on-screen resources exists. However, we have not yet explored this research.

For all designers of resources for use in schools, there are multiple choices about the language they use. One choice, for example, is the way in which they address their audience. In the MAP lesson guides, the teacher is addressed as 'you' and in places is 'told' what to do (e.g. 'Ask students to work in groups of two or three. Give each group some blank paper …') but in other places the language is less directive (e.g. 'We suggest that you do not score students' work). Many suggestions are accompanied by explanations. The editors of the "Aiming Higher" series addresses their audience (teachers whose first language is likely to not be

English) using 'simple language' and a 'respectful' tone (quotations taken from an interview with Christine Hopkins, co-editor of the series, on 3rd July 2014). Paul

Ginnis, in our email conversation, stated that he was aimed for a conversational style, in order to create an informal accessible tone.

Our understanding is that designers address their audience in ways that are implicit within their cultural contexts. We suspect that many of their decisions in this respect are not thoroughly explored and we would welcome so research into the response of audiences to the ways in which they are addressed.

Concluding comments

This document is intended as a starting point for discussions within FaSMEd about the design decisions related to the toolkit. It will be clear to the reader that we are not yet well enough informed about the research into aspects of the literature, but that we intend to further investigate what is known about the design of toolkits.

In addition we hope to develop our understanding through conversations with the consortium partners as we are well aware of the experience and expertise of various members of the consortium in designing materials for classroom use and professional development. We believe that we can draw on this experience and expertise, together with that reported in the research literature and our own small scale research, to inform the design of an excellent toolkit for FaSMEd.

References

AIMSSEC. (n.d.). Aiming Higher. Retrieved June 16, 2014, from http://aiminghigh.aimssec.org/

Burkhardt, H. (2009). On Strategic Design. *Educational Designer*, *1*, 1–49. Retrieved from http://www.educationaldesigner.org/ed/volume1/issue3/article9/pdf/ed_1_3_burkhardt_09.pdf

CommNet. (n.d.). Education FAB Toolkit. Retrieved June 16, 2014, from http://commnet.eu/01_About_CommNet/Commnet_Community/Education/FAB_Toolkit/Education_FAB_Toolkit.kl

Dede, C., Jass Ketelhut, D., Whitehouse, P., Breit, L., & McCloskey, E. M. (2008). A Research Agenda for Online Teacher Professional Development. *Journal of Teacher Education*, *60*(1), 8–19. doi:10.1177/0022487108327554

Edumatics. (n.d.). Edumatics Home. Retrieved June 16, 2014, from http://www.edumatics.mathematik.uni-wuerzburg.de/en/

Fundamental Rights Agency & International School for Holocaust Studies. (n.d.). The Toolkit on the Holocaust and Human Rights Education in the EU. Retrieved June 16, 2014, from http://fra.europa.eu/fraWebsite/toolkit-holocaust-education/teachers-toolbox.htm

Ginnis, P. (2002). *The teacher's toolkit*. Crown Publishers. Retrieved from http://www.crownhouse.co.uk/publications/look_inside/9781899836765.pdf

ISDDE. (n.d.). International Society for Design and Development in Education: A background paper.

Joubert, M., Back, J., DeGeest, E., Hirst, C., & Sutherland, R. (2009). *Final Report: Researching Effective CPD in Mathematics Education (RECME)*. Sheffield. Retrieved from https://www.ncetm.org.uk/enquiry/9251

Joubert, M., & Sutherland, R. (2009). *A perspective on the literature : CPD for teachers of mathematics. NCETM* (p. 132). Sheffield. Retrieved from https://www.ncetm.org.uk/enquiry/9336

Korthagen, F., Loughran, J., & Russell, T. (2006). Developing fundamental principles for teacher education programs and practices. *Teaching and Teacher Education*, *22*(8), 1020–1041. doi:10.1016/j.tate.2006.04.022

Marrongelle, K., Sztajn, P., & Smith, M. (2013). Scaling Up Professional Development in an Era of Common State Standards. *Journal of Teacher Education*, *64*(3), 202–211. doi:10.1177/0022487112473838

Mascil. (n.d.). A toolkit for professional development. Retrieved June 16, 2014, from http://mascil.mathshell.org.uk/

Mckenney, S. (2013). Formal education of curriculum and instructional designers. *Educational Designer*, *2*, 1–20.

PRIMAS-team. (n.d.). Primas: Running professional development courses. Retrieved June 16, 2014, from http://www.primas-project.eu/artikel/en/1300/professional-development/view.do

Region 13 Educator Certification Program. (n.d.). The Teacher Toolkit. Retrieved June 16, 2014, from http://www.theteachertoolkit.com/index.php/tool/all-tools

Schneider, R. M. (2012). Opportunities for Teacher Learning During Enactment of Inquiry Science Curriculum Materials: Exploring the Potential for Teacher Educative Materials. *Journal of Science Teacher Education*, *24*(2), 323–346. doi:10.1007/s10972-012-9309-9

Swan, M. (2008). Designing a Multiple Representation Learning Experience in Secondary Algebra. *Educational Designer*, *1*(1), 1–17. Retrieved from http://www.educationaldesigner.org/ed/volume1/issue1/article3/pdf/ed_1_1_swan_08.pdf

University of Nottingham. (n.d.). Mathematics Assessment Project. Retrieved June 16, 2014, from http://map.mathshell.org.uk/materials/index.php

Vosniadou, S., Ioannides, C., Dimitrakopoulou, A., & Papademetriou, E. (2001). Designing learning environments to promote conceptual change in science. *Learning and Instruction*, *11*(4-5), 381–419. doi:10.1016/S0959-4752(00)00038-4