SMASH: A Blended-Learning Approach to Parent Educator Training in Mathematics and Science

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Abstract
Acknowledging the central role of parents in children’s learning, the EU-funded project SMASH aims to raise the educational standards of European youth in mathematics and science by cultivating underlying home cultures as springboards for learning. The project consortium has developed an innovative intercultural parent-trainer training course and related resources for professionals involved in parent education initiatives. The course provides these professionals with current knowledge, techniques, and implementation tools for the provision of high-quality, culturally differentiated training in mathematics and science education to parents of elementary and middle school children (ages 6–15) in their communities. Online multilingual resources support and promote the program’s activities and objectives by offering open access to the parent-trainer training course content and tools.

Introduction
In technology-based society where mathematics and science provide essential knowledge tools and the foundations for more advanced or specialized training either in higher education or through lifelong learning, several studies indicate the lack of mathematical and scientific competence of a considerable proportion of both the adult and student population around Europe (e.g. Trends in International Mathematics and Science Study; Program for International Student Assessment). Research also indicates that pupils with poor quantitative skills are likely to have fallen behind by the age of 10. Thus, if the European Union is to achieve the objective set by the European Council for a considerable increase in the number of European college-level students graduating in mathematics, science and technology and pursuing technical careers, it should put more focus on improving student achievement in mathematics and science at a young age (Commission of the European Communities, 2007). The Joint Interim Report Education and Training 2010 adopted by the Council and the Commission in 2004 highlights the need for accelerated reforms and calls on member states to take action in order to motivate young people to take a greater interest in science and mathematics and to undertake scientific and technical studies and careers (Council of the European Union, 2004). Several of the Lisbon Education and Training Indicators measure progress towards improved recruitment and performance of students in mathematics and science.
Parents are central contributors to a child’s education, thus having them involved and engaged in the educational process of their children is of paramount importance to the children’s academic achievement in mathematics and science. The research literature indicates a very strong positive relationship between school performance and a home environment conducive to learning (Carter, 2002; Chen, 2001; Downey, 2005; Huntsinger, Jose, & Ching, 1994; Kellaghan, Sloane, Alvarez, & Bloom, 1993). Given the fundamental changes that have occurred in both the content and the pedagogy of mathematics and science, the majority of parents do not have the knowledge needed to create an environment within the home that fosters their children’s development and is coordinated with classroom work. The vast majority of parents encountered school mathematics and science as drill-oriented subjects made up of rules and procedures to be memorized, thus many of them maintain a very algorithmic approach and, often, negative attitudes towards the subjects. Moreover, most parents lack the knowledge to guide their children towards constructive uses of technology in support of their learning and developmental needs (Mavrotheris, Meletiou-Mavrotheris, & Maouri, 2004; Ramboll Management, 2006).

Parent education is considered an “essential component” of successful parental involvement (Covarrubia, 2000; DiCamillo, 2001; Freedman & Montgomery, 1994). To spur reform in mathematics and science education, parents should be provided with guidance on how to enhance their children’s learning experiences.

SMASH (Success in Math and Science at Home), a project funded by the European Union under the Lifelong Learning Program/Grundtvig action, was proposed in response to the need for reaching out to parents and informing them about new developments in mathematics and science education. The overall aim of the program, which had a 2-year duration (December 2007–November 2009), was to offer high-quality training to parent educators around Europe that would equip them with the required knowledge, skills, and resources to provide professional guidance to parents of elementary and middle school children (ages 6–15) in how to best support their child’s development in mathematics and science. More specifically, the project consortium, comprised of seven partner institutions in five European countries (Cyprus, Greece, Spain, Czech Republic, and UK), had the following objectives:

- Develop, pilot test, and offer an intercultural parent-trainer training course for European teachers, school administrators, representatives of parent associations, and others involved in training activities for parents, that will prepare them through combined use of e-learning and physical meetings to implement in their communities culturally differentiated parent-training programs for supporting children’s development in mathematics and science.

- Develop, pilot test, and distribute to parent educators for use in their parent-training programs a culturally differentiated training pack for parents offering technology-enhanced, research-based educational aids and resources for parents to
support the development of their children’s mathematical and scientific knowledge and skills.

- Design and develop a multilingual information base to support and promote the program’s activities and objectives by offering open access to the parent-trainer training course content and pedagogical approach, to the parent training pack, and to various other links and resources.

- Initialize networking among parent educators across Europe by building an online community for the exchange of ideas, content, tools, and didactic approaches relating to parent education in mathematics and science. The long-term objective is to sustain and, if possible, to expand this community into a pan-European network of communication.

This article provides an overview of the SMASH project. First, it describes the key activities during the project. Next, it provides an overview of the SMASH parent-training course design: course objectives, pedagogical and didactical approach, and course content and structure.

**Key Stages of SMASH Program Development**

In the two-year timeframe of the SMASH program, the following activities took place in order to achieve the project objectives:

*Development of a pedagogical framework for parent training in mathematics and science*

At the outset of the project, the consortium worked towards developing a framework for best practices in parent training programs in mathematics and science education through combined use of e-learning and physical meetings. The preliminary design of the framework which guided the design of the parent-trainer training course was based on desk research into the different approaches to parent education used across Europe and internationally taking into account cultural differences in teaching and learning methods, as well technical considerations regarding online course delivery (e.g. current limitations in terms of equipment, software, protocols, and network bandwidth). The pedagogical framework was validated during the pilot delivery of the parent-trainer course and was revised accordingly.

*Development of parent-trainer training course and accompanying parent training pack*

The consortium designed the parent-trainer training course pack and the accompanying parent-training pack based on the guidelines set in the pedagogical framework. Material was developed in English and translated into the partners’ national languages (Greek, Czech, and Spanish). It is culturally differentiated to accommodate local conditions in each participating country.
Design and development of information base infrastructure and services
In parallel to the development of the instructional material, the team worked on the technical design and development of an online information base to support the project activities and outputs. The information base, implemented as a multilingual web portal, supports anytime, anywhere education and collaboration of parent educators and parents around Europe. It includes the parent-trainer and parent training packs developed through the project and a variety of other distance learning tools and resources for parent educators and parents, including forums for discussion and networking between parent educators and parents (e.g. e-mail, chat rooms, discussion forums, Wikis, etc.).

Pilot testing and validation of the parent-trainer course and accompanying parent training pack
A pilot delivery of the parent-trainer training course took place during the spring of 2009. Before being offered to the EU educational community, the parent-trainer training course and its accompanying parent training pack were pilot tested locally in three of the partner countries (Cyprus, Spain, and the Czech Republic) on groups of 15–20 parent educators per country. Upon completion of the parent-trainer training course, some of the course participants ran parent training workshops in their respective communities, using the parent training pack developed by the consortium. Instructional materials and services were revised based on the feedback received from the pilot delivery of the course and the follow-up parent training workshops. The overall feedback from the target user groups from all three partner countries participating in the SMASH course pilot delivery, as well as from external experts, regarding the course content, services, and didactical approaches has been very positive. The key conclusion from the analysis of the data obtained during the pilot parent-trainer training course delivery was that SMASH was quite successful in providing course participants with the required knowledge and tools to plan, and design, and implement effective parent training seminars in mathematics and science education. The follow-up parent-training seminars organized by some of the parent educators trained through the program were met with great enthusiasm by parents. The vast majority of parents participating in these seminars rated them very positively, agreeing that their participation in the seminars increased their awareness of the many ways in which they could promote their children’s mathematical and scientific development through informal, family-based practices.

Offering of Grundtvig parent-trainer training course
The revised parent-training course entered the EU Lifelong Learning Program Training Database for increasing visibility and access to parent educators across Europe. It was offered as a Grundtvig in-service training course targeting school and/or adult mathematics and science teachers, school administrators, counselors, representatives of parent associations, or other professionals involved in training activities for parents. The course was offered once during the project lifetime (Fall 2009, Prague, Czech Republic).

Information base content and services enrichment
At the end of the project, final revisions and enhancements to the project information base content and services were made and it was then opened not only to the parent-trainer
training course participants, but to all interested parents and parent educators. The information base integrates a variety of resources and distance learning and communication tools including:

- a “hypertextbook” with the content of the parent-trainer training course to be used as a self-paced course, in a facilitated online mode, or as part or all of the material used in a face-to-face course or workshop;

- the accompanying parent training pack which could be used by distance-learning organizations delivering training to groups of parents and/or other adult end-users, or for independent study by individual parents;

- collaboration tools supporting dialogue and exchange of ideas between European parents and parent educators, such as forums of discussion, chat rooms, and application sharing;

- reports and articles developed through the project;

- links to mathematics and science education resources available on the Internet.

The open access to the project outcomes and the information published through the information base by users outside the consortium helps improve the collective knowledge of the mathematics and science parent and parent educator communities by supporting the sharing of multiple, multinational perspectives, and by facilitating easier flow of information among stakeholders.

**Design of SMASH Parent-Trainer Training Course**

The main outcome of the SMASH project is the intercultural parent-trainer training course offered to the European educational community. As already pointed out, the revised SMASH course has entered the EU Lifelong Learning Training Database to increase access to large numbers of educators involved in parent education around Europe. Despite the official conclusion of the project, the consortium will continue to offer the parent-trainer training course as a LLP Grundtvig course in the forthcoming years. We expect to offer the course at least twice yearly. Two offerings of the course have been scheduled for 2010: June 6–13, Nicosia, Cyprus; July 20-27, Prague, Czech Republic.

We next provide an overview of the *SMASH* course design: course objectives, pedagogical and didactical approach, course content, and course structure.
Objectives of the Parent-Trainer Training Course

The SMASH course aims to equip parent educators with the required knowledge, techniques, and implementation tools for the provision of high-quality, culturally differentiated training in mathematics and science education to parents of elementary and middle school children (ages 6–15) in their communities. Parent educators trained through the program gain expertise in how to plan, design, and facilitate an effective parent training course in mathematics and science education. They:

• develop effective strategies for parent training by getting acquainted with the main principles of adult mathematics and science learning, and of parent education;

• gain better understanding of informal mathematics/science education and inquiry and of ways to encourage family-based informal mathematics/science education practices;

• become familiar with innovative methodologies, tools and technologies that parents can employ at home to facilitate their children’s learning;

• become familiar with the rationale and content of the parent-training pack prepared by the consortium and with ways to facilitate its use during the parent-training course;

• develop strategies for promoting parental engagement and learning and particularly for increasing the involvement of “hard to reach families”; 

• learn how to convey complicated scientific ideas in a simple language that families can understand; and

• learn how to effectively communicate with parents coming from different cultural and/or socio-economic backgrounds.

Thus, parent educators completing our course are equipped with the necessary knowledge, tools, and resources to provide high-quality training in mathematics and science education to parents in their communities. Consequently, we expect that these professionals will, in turn, offer parent training programs that will help the parents:

• increase their awareness of the value and importance of mathematics and science literacy for their children’s futures;

• better appreciate how mathematics and science are connected to everyday experiences and learn how to help their children to make the connection;
• gain a better understanding of informal mathematics and science education and inquiry;

• become more skilled and confident in nurturing their children’s (and their own) learning and growth in mathematics and science;

• learn how to foster their children’s natural curiosity about the world, how to appropriately address their informal mathematics and science inquiries, and how to assist them in exploring the world around them;

• become familiar with a variety of innovative methodologies, tools, and technologies they can employ at home to support their children’s informal mathematics and science learning;

• learn more about educational programs and how the school works; and

• become better equipped to support and monitor their children’s mathematics and science learning at school.

**Pedagogical and Didactic Approach**

The theory of learning underlying SMASH is social constructivism. The design of the program has been based on the importance of dialogue and collaboration between parents, parent educators, and researchers, and of inquiry and exploration as a process of knowledge construction (Ponte, 2001). The program was jointly designed by a multinational consortium of educators, representatives of parents’ and teachers’ organizations, experienced distance learning instructors, authors of technology supported courses, and technicians in order to ensure consideration of all different perspectives into the integrated pedagogical framework. Particular care has been taken to build on parents’ knowledge and experiences and to respect cultural differences in parenting approaches (Onikama, Hammond, & Koki, 1998). Educators participating in the parent-trainer training course developed through the project are trained to provide parent training that goes beyond the transfer of knowledge and development of skills, but is rather based on dialogic learning (Flecha, 2000) viewing parents as valuable intellectual resources to the learning process (Civil, 2002).

SMASH has adopted “learning” and “community” rather than “instructional” models of parent-trainer training (Barab & Duffy, 2000). A central conviction underlying the program is that learning is a social act best supported through collaborative activities (Vygotsky, 1978), and thus learning as part of a community of practice can provide a useful model for adult educator training. The SMASH parent-trainer training course promotes intercultural awareness and exchange of experiences and ideas among European parent educators. Course participants interact and learn from each other by engaging in joint activities and discussions, helping each other, and sharing best pedagogical strategies. Through these interactions, they build relationships and construct
a multinational community that supports best practices and innovation in parent training in mathematics and science education.

SMASH course participants are provided with ample opportunities for interactive and collaborative learning through use of a wide array of tools, artefacts, and resources (Gordon, Petocz, & Reid, 2007). They are actively involved in constructing their own knowledge through their participation in authentic educational activities such as projects, experiments, computer explorations with real and simulated data, group work, discussions, and reflection on one’s own and on others’ ideas and experiences. Through use of these strategies, we offer a learning environment that serves as a model to the participating parent educators as to the type of learning situations, technologies and curricula they could employ in their parent training workshops.

Course Content
The project consortium has designed the parent-trainer training course pack and the accompanying parent-training pack based on the guidelines set in the project pedagogical framework developed at the beginning of the program. The parent-trainer training course pack provides a state-of-the-art overview of new pedagogical methodologies and didactical routes in parent education. It explores a broad range of topics of interest to mathematics and science parent educators including: principles of child psychology and mathematics and science learning; computer-supported teaching and learning; principles of adult mathematics and science learning; parental involvement and student achievement; basic principles of parent education; recommended practices for promoting parental engagement and learning (e.g. family mathematics and science nights, family involvement case studies); and evaluation of parent education programs. Special emphasis has been paid to EU transversal policy issues, such as promoting participation of females, integration of disabled people, and inclusion of socially and economically excluded families.

The parent-training pack offers technology-enhanced, research-based and culturally adapted educational aids and resources to support children’s development in mathematics and science at home to be adapted and used by parent educators in their parent training programs. It consists of multimedia based training modules, to be delivered as a series of mini-workshops, that familiarize parents with some general principles of learning, with learning theories specific to mathematics and science, as well as with the use of learning technologies (e.g. use of state-of-the-art mathematics and science educational software as well as general-purpose software like Excel, guidelines for selecting appropriate educational software and for making Internet surfing conducive to learning).

An isomorphic approach has been adopted for the development of course material targeting parent educators and parents. The program aims at educating parent educators and parents in the same principles and common language to ensure the sharing of similar understandings regarding the ways in which parents can reinforce children’s learning of mathematics and science at home. The intent is not to remediate or compensate for skills
taught in school, but to spark children’s scientific interest and to stimulate their informal learning of mathematics and science.

The teaching strategies employed in both the parent-trainer and the parent-training course to educate parent educators and parents about ways to promote informal mathematics and science learning at home, include the following:

- project-based learning,
- inquiry-based learning,
- case-based learning/ scenario based learning, and
- role playing.

Course Structure
Parent educators receive training through combined use of e-learning and physical classroom meetings. The course is made up of three parts:

1.) One-week intensive training seminar. At the course beginning, parent educators from around Europe gather together to attend a 6-day long intensive seminar. They become familiar with the course and its objectives and with the facilities offered by the course e-Learning system. More importantly, they get the chance to get to meet and interact with one another, share issues and problems, as well as exploit the course facilitators’ presence to ask questions about things they are unsure of. This initial in-person meeting reinforces parent educator online engagement (Kavanaugh, Carroll, Rosson, Zing, & Reese, 2005) since it helps mitigate the problem of trust and social presence online (Ardichvili, Page, & Wentling, 2003).

The seminar consists of a combination of mini-workshops that include technology-based and hands-on activities in small groups, study visits, presentations by experts, role-play, videos documenting learning activities of parents with children, and discussions. During the seminar, particular emphasis is given to enhancing parent educators’ skills in adapting the provided parent training material based on the context-specific needs and interests of parents in their community. The language of tuition is English.

2.) ICT-mediated instruction using the project information base. The second part of the course is delivered online by using the interactive information base built specifically for this project. Parent educators review the material provided to them during the Intensive Training Seminar and prepare for their guided field practice. Online moderated discussions — both asynchronous and synchronous — allow participants to share content, ideas, and instructional strategies.

3.) Guided field practice. At the final stage, parent educators undertake a teaching experiment. They customize and expand upon the parent-training materials provided to them and apply them in their own communities. Parent educators write up their experiences, including a critical analysis of their work and that resulting from parents. This helps them to reflect on their practice and apply self-criticism constructively. Once
the guided field practice is completed, parent educators report on their experiences to the other course participants and exchange ideas and insights as to how to further improve their parent training practices.

Delivery of the course is facilitated by members of the consortium from all participating countries with expertise in mathematics and/or science education. Since the course has been designed to be a community-based learning experience, the role of the training team is to guide the discussions and encourage full, thoughtful involvement of all participants, and to provide feedback. Facilitators help to deepen the learning experience for course participants by encouraging productive interaction and critical reflection on workplace practices.

Upon successful completion of the course, participants are certified as authorized educators to run the parent training program developed through this project.

Concluding Remarks

In a technology-based society, mathematics and science literacy are among the key competencies that all individuals need for employment, inclusion, subsequent learning, as well as personal fulfillment and development (Commission of the European Communities, 2002). These competencies should be acquired by the end of compulsory schooling, since they are a prerequisite for participation in lifelong learning.

Recognizing the crucial role of mathematics and science education in achieving sustainable development and fulfilling the personal aspirations of European citizens, the SMASH project aspires to raise the educational standards of European youth in these disciplines through building European parents’ capacity to contribute towards raising their children’s achievement in mathematics and science. Taking into account best practices in mathematics and science education, adult education, parent education, and distance learning, the project aims to enrich European elementary and middle school children’s learning of mathematics and science through cultivating underlying home cultures as springboards for learning. The parent-trainer training course developed through the project goes far beyond traditional adult training practices. It builds parent educators’ knowledge and skills through a hands-on, inquiry-based approach that seamlessly combines best pedagogical practices with contemporary technologies, including the Internet for maximum flexibility.

A central conviction underlying SMASH is that learning is a social act best supported through collaborative activities (McConnell, 2000; Vygotsky, 1978), and thus learning as part of a community of practice can provide a useful model for adult educator training. While the program employs innovative technological tools and resources to support educationally useful human-computer interactions, its focus is on exploiting technology to support human-human interactions (Barab, Makinster, Moore, & Cunningham, 2001).
The SMASH parent-trainer training course provides a virtual space where European mathematics and science parent educators with a broad range of experiences and expertise can come together to reflect upon relevant education theory and practice, to exchange ideas and resources, and to build collaborations. Course participants are encouraged and expected to engage in joint discussions and to work collaboratively in completing projects and other assignments. The aim is to build an open knowledge-building and sharing environment that fosters sustained participation and allows parent educators to take an active role in and ownership for the creation of their community (Barab & Duffy, 2000).

Maximum dissemination of the project outputs and services in different cultural contexts and long-term sustainability is being achieved through its information base, which supports multilingual interfaces, collaboration of parent educators around Europe, and accumulation of collective knowledge from end users. The information base offers access to validated pedagogical models, didactic approaches, and technology-enhanced and culturally-adapted resource materials for parent educators and parents that are of use not only to the project participants, but also for independent study. The ultimate beneficiaries of the project are children, who will eventually benefit from a conducive to learning home environment that enhances their mathematical and scientific development and prepares them to meet the challenges of the digital age.

References


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