

SMASH: ONLINE TRAINING IN MATHEMATICS AND SCIENCE EDUCATION FOR PARENTS

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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 (IALS, PISA, TIMSS). Research also indicates that pupils with poor quantitative skills are likely to have fallen behind by the age of ten. 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 the 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 their academic achievement in mathematics and science. The research literature indicates a very strong positive relationship between school performance and a conducive to learning home environment (Carter, 2002; Chen, 2001; Downey, 2005; Huntsinger et al., 1999; Kellaghan et al., 1993). Given the fundamental changes that have occurred in both the content and pedagogy of mathematics and science, the majority of parents do not have the needed knowledge to create an environment within the home that fosters their child'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 necessary knowledge to guide their children towards constructive uses of technology in support of their learning and developmental needs (Becta, 2001; Mavrotheris et al., 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 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 SMASH program, which has a 2-year duration (December 2007–November 2009), is to offer high-quality training to parent educators around Europe that will 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. To achieve this aim, the project consortium — comprised of seven partner institutions in five European countries (Cyprus, Greece, Spain, Czech Republic, and UK) — has/will undertake the following during the lifetime of the project:

- 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.

A pilot delivery of the parent-trainer training course is currently underway. The SMASH course is being tested locally in three of the partner countries (Cyprus, Spain, Czech Republic), on groups of 15–20 parent educators per country. Upon completion of the parent-trainer training course, some of the course participants will run parent training workshops in their respective communities, using the parent training pack developed by the consortium. Various forms of assessment tools and protocols are being used to collect and document evidence of changes in parent educators' pedagogical and content knowledge of mathematics and science, attitudes towards the subjects and teaching practices, and the impact that these changes might have on their ability to provide effective parent training. The analysis of these data will inform the revision of the instructional materials and services.

The revised parent-training course will enter the EU Lifelong Learning Training Database for increasing visibility and access to parent educators across Europe. Final revisions and enhancements will also be made to the information base

content and services, and it will then be opened to all interested teachers and teacher educators.

This paper provides an overview of the SMASH parent-training course design: course objectives, pedagogical and didactical approach, and course content and structure. At the conference, we will also be able to present a synopsis of the main findings from the course pilot delivery.

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 will be trained in how to plan, design, and facilitate an effective parent training course in mathematics and science education. They will:

- 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;
- get familiarized with innovative methodologies, tools and technologies that parents can employ at home to facilitate their children's learning;
- get familiarized 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.

Pedagogical and Didactic Approach

The theory of learning underlying SMASH is social constructivism. The design of the parent-trainer training course 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 course has been 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 et al., 1998). Educators participating in the parent-trainer training course developed through the project will be 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). The SMASH parent-trainer training course promotes intercultural awareness and exchange of experiences and ideas among European parent educators. Course participants will 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 will build relationships and construct a multinational community that will support best practices and innovation in parent training in mathematics and science education.

SMASH course participants will be provided with ample opportunities for interactive and collaborative learning through use of a wide array of tools, artefacts and resources (Gordon et al., 2007). They will be 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 aim to offer a learning environment that will serve 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.

The *SMASH* Course Content and Structure

As already pointed out, the revised SMASH course will enter the EU Lifelong Learning Training Database to increase access to educators around Europe. It will

be offered as a Grundtvig 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 SMASH course has been scheduled for offering twice during Fall 2009, in two of the partner countries (Cyprus and the Czech Republic). After completion of the project, the consortium will continue to offer the parent-trainer training course as a LLP Grundtvig course, thus increasing access to large numbers of educators involved in parent education.

Next, we offer a brief description of the SMASH course content and structure.

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 the mathematics and science parent educators, including the following: (i) Principles of child psychology and mathematics and science learning; (ii) Computer-supported teaching and learning; (iii) Mathematics and science curriculum issues; (iv) Principles of adult mathematics and science learning; (v) Parental involvement and student achievement; (vi) Basic principles of parent education; (vii) Recommended practices for promoting parental engagement and learning (e.g. family mathematics and science nights, family involvement case studies, etc.); (viii) 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, with school curricula, 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, etc.).

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
- role playing
- narrative method — learning through stories

Material has been developed in English and will be translated into the partners' national languages (Greek, Czech, Spanish). It will be culturally differentiated to accommodate local conditions in each participating country. The content is in digital form and will be available online via the project information base. It will also be available in CD/DVD format to overcome potential bandwidth limitations.

Course Structure

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

(i) One-week Intensive training seminar: At the beginning of the course, parent educators from all over Europe will gather together to attend the seminar (they can finance their expenses by applying for a grant under the Lifelong Learning/Grundtvig-program). Course participants will be introduced to the objectives of the parent training program developed by the consortium and the pedagogical framework underlying its development, and will be offered background literature and practical strategies for effectively leading parent groups. They will also be familiarized with the facilities offered by the course e-Learning system. More importantly, they will get the chance to meet and interact with one another, and share issues and problems. We believe that this initial in-person meeting will reinforce parent educator online engagement (Kavanaugh et al., 2005) since it could mitigate the problem of trust and social presence online (Ardichvili et al., 2003).

The Intensive Training Seminar will have a six-day duration and will consist of a combination of mini-workshops that will include technology-based and hands-on activities in small groups (5–6 persons), presentations by experts, role-play, videos

documenting learning activities of parents with children, and discussions. During the seminar, there will be particular emphasis on enhancing parent educators' skills in adapting the provided parent training material based on the context-specific needs and interests of parents in their community. Language of tuition will be English.

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

(iii) Guided field practice: At a final stage, parent educators will undertake a teaching experiment. They will customize and expand upon the parent-training materials provided to them, and apply them in their own communities. Partners will act as mentors, providing their support to parent educators using online communication tools. Once the guided field practice is completed, parent educators will report on their experiences to the other parent educators, and exchange ideas and insights as to how to further improve their parent training practices.

Upon successful completion of the course, participants will get certification as authorized trainers 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 fulfilment 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 et al., 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 will come together to reflect upon relevant education theory and practice, to exchange ideas and resources, and to build collaborations. Course participants will be 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 will foster sustained participation and will allow parent educators to take an active role 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 will be 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 will be of use not only to the project participants, but also for independent study. The ultimate beneficiaries of the project will be children who will 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.

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