

National policy papers on issues and strategies for IBST

mathematics and science for life



mascil

mascil aims to promote a widespread implementation of inquiry-based teaching (IBL) in math and science in primary and secondary schools. It connects IBL in schools with the world of work making math and science more meaningful for young European students and motivating their interest in careers in science and technology.

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Contact Information

Coordinator: University of Education Freiburg, Prof. Dr. Katja Maaß
Lead partner for this deliverable: Kathy Kikis-Papadakis
Website: www.mascil-project.eu



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Executive Summary

Background

This report stems from work *developed in the frame of the mascil* (mathematics and science for life) project's second work package (**WP2**), entitled 'Educational systems and policy contexts'. One of the main **goals of this workpackage** is to initiate a dialogic process with policy makers at national and European level, aiming to make out and remove obstacles and bare possibilities of cooperation and synergies between circles of research, policy and practice in order to promote of inquiry based learning in the world of work context. To address this objective, **previous work** within this workpackage reported on September 2013 (see D2.1 National working papers on analysis of policy contexts¹) provided **a detailed account of policy contexts in the 13 European countries** of the consortium under the scope of investigating the contextual and regulatory conditions under which teachers are called to implement (or not) inquiry based and context based approaches to their teaching. Information provided in the 13 national working papers were then synthesized and analysed, with an aim to identify differences and commonalities among the participant countries and to **provide recommendations to inform the development of future policy in national and European settings** (see D2.2 Cross-national report and policy paper, reported on March 2014²). **The current work** builds on the general conclusions and recommendations for policy makers published in D2.2, by reporting on **the processes and outcomes of the negotiation with national policy makers on how these conclusions and recommendation can be more effectively contextualized and put more concrete**. As such, this work contributes from a policy perspective to one of the broader goals of the mascil project, the widespread uptake of inquiry-based learning in science and mathematics teaching in rich vocational contexts.

Aims and purpose

This document reports on **the processes and outcomes of the national workshops** with policy makers that were conducted in the frame of WP2 of the mascil project from **January 2014 till May 2014** in **12 countries** of the consortium, namely: Germany, Greece, the Netherlands, Spain, Cyprus, Norway, Romania, Czech Republic, Turkey, Lithuania, Austria and Bulgaria. During this period, consortium partners **established a dialogue process through national workshops with policy makers** in their countries, engaging in total **more than 250 stakeholders** (policy developers and implementers). The partners and the policy makers addressed issues that emerged from the analysis of the national education contexts reported in D2.2 **with an aim to** investigate in detail and depth their own policy context and to consider how the strategic aims of policy priorities can not only be achieved but also negotiated for further educational improvement. **The report provides a detailed account for each national context in terms of:** the national policy workshops approach and methodology, the rationale for selection of policy makers and the specific issues for discussion in each workshop, the implementation

¹ The deliverable is available in the project's website: <http://www.mascil-project.eu/reports-and-deliverables.html>

² The deliverable is available in the project's website: <http://www.mascil-project.eu/reports-and-deliverables.html>

process and outcomes of the discussions, as well as recommendations that emerged from the discussion on how to achieve the widespread uptake of inquiry-based learning in science and mathematics teaching in rich vocational contexts.

Procedural methodology

In order to achieve the main aim of the work reported, i.e. to foster the synergies among research, policy and practice fields, by producing strategies to support the widespread up-take of inquiry based teaching in world of work context, we identified **two main challenges**:

- a) *to actively engage of policy makers* – defined as influential stakeholders in each country- in the in the process of reflecting on/for inquiry based learning and world of work issues during national workshops and
- b) *to address diversity* among the participant countries in the effort to meet project objectives (i.e. cultural, thematic, applied methodology).

With a view to address these challenges so to facilitate the establishment of a dialogic process through national workshops with policy makers in each country, the following methodological steps were made in the planning, implementation and documentation phase:

- **Development of briefing paper** “National policy workshops and National policy papers”, **guidelines for planning and implementation** of National Policy workshops (discussed in the project meeting in December 2014), which provided information on the focus, the planning and the implementation of the national workshops, as well as the tasks and deadlines, for both implementation and documentation of the workshops (see Appendix).
- **Production of initial plans for national policy workshops** by each partner country, exchange of ideas in the project meeting through a gallery walk (country posters on national planning), during the project meeting in December 2014
- **Consolidation of the initial plans** for the policy workshops in each country in a document (as they were visualized and discussed in the project meeting on December 2014). The working document provided information on the plans for each national workshop in terms of: purpose, target groups, main topics, role of the NAB, implementation method, challenges; it was sent to the partners for revisions of their initial plans after the meeting.
- **Updates/revisions on initial plans** were made with partners’ feedback on new ideas/plans after having an overview of all countries workshop plans, January 2015
- **Active engagement of National Advisory Boards (NAB)** in the process of planning and implementation of national policy workshops (both as participants and as mediators for policy makers recruitment)
- **Implementation of national policy workshops** in 12 out of 13 countries³, engaging in a dialogic process policy makers, investigating in more detail and depth their own policy context and considering how the strategic aims of policy

³ Due to national elections in UK it was not possible for UK partner to engage policy makers in a policy workshop before June 2015. Their national workshop is scheduled for September 2015, allowing time for analysis of outcomes for D2.4. A statement on the situation in UK is given in detail in one of the chapters in the following.

priorities can not only be achieved but also negotiated for further educational improvement

- **Monitoring of implementation of the workshops** in the countries (where partner countries are, problems or risks during/for implementation/documentation and feedback for addressing problems).
- **Exchange of workshop experiences** in the project meeting (May 2015), reflections on processes and outcomes, partners discussion and feedback on what they have learned from their experience on workshop planning and implementation - identifying strengths, weaknesses, opportunities and threats (SWOT) of their national policy workshops in the dimensions of: planning, networking, implementation, outcomes and reporting
- **Documentation of the processed and outcomes** of the national workshops with the aid of a common template (as in the Briefing Paper mentioned above)

The above methodological steps resulted in the production of 12 national papers reported in the main body of this document. The national papers will lay the ground for the analysis of the outcomes of the policy workshops and the production of policy recommendations on how best to support inquiry based learning approaches in world of work contexts (Deliverable 2.4, due December 2015).

Summary and Conclusion

The main body of this document provides a detailed account in each country of the processes and outcomes of the national policy workshops that took place within the WP2 of the mascil project, aiming at engaging in a reflection and negotiation process policy makers on how to contribute to a widespread uptake of inquiry based approaches in rich vocational contexts. As evident in the national papers, **the main aim of the task has been successfully achieved** as we managed to **implement 12 national workshops** in Germany, Greece, Netherlands, Spain, Cyprus, Norway, Romania, Czech Republic, Turkey, Lithuania, Austria and Bulgaria, **establishing dialogic process with more than 250 influential stakeholders** (policy developers and implementers). The methodological procedures that we followed allowed to **successfully address the two main challenges that we faced** during the conduction of the work: **the active engagement of policy makers** – achieved by the careful selection of participants with the aid of the national advisory boards (NABs) – and **the diversity among the participants countries** – addressed by allowing flexibility in workshop methodology, in the target groups selection and in the focus on the topics discussed in each workshop.

The document also provides an **overview of each workshop case** by highlighting the **strengths, weaknesses, opportunities and threats (SWOT analysis)** in the dimensions of: **planning, networking, implementation, outcomes and reporting of each workshop**. Such an overview serves two purposes within mascil: First to **guide further activities in the project** – in particular those that involve policy makers- by identifying the elements that contributed to the success of the work conducted and by pinpointing difficulties that have been (and should further be) addressed in order to meet project objectives. Second, this work **will lay the ground for the analysis of the outcomes of the policy workshops**, that is schedule for the next phase of work within WP2, by providing axes of the analysis of the national

papers in order to produce a plan of action on how best to involve policy makers into the project endeavour - which will turn into action via further networking activities in each counties (Final Policy Paper, due December 2015).

Recommendations

Based on the identification of the elements that contributed to the success of the work conducted and as well as of the difficulties that have been addressed in order to meet work objectives –as a result of the SWOT analysis- the following lines provide **recommendations for the mascil partners** in order to **guide further activities in the project**, in particular those that involve policy makers.

- In the process of planning, **helpful conditions** for engaging policy makers in reflecting and negotiating on mascil priorities are: Take advantage of new curricula that align to the projects aims (Germany, Spain, Lithuania); take advantage of connections and collaboration with other projects (the Netherland, the Czech Republic, Norway); participate in regional events that engage policy makers (Romania); careful selection of target groups (Greece, Bulgaria); focus on influential people (Germany); take advantage of NAB and PD networks within mascil (Lithuania, Romania)
- The following **obstacles should be taken into consideration** when planning activities that involve policy stakeholders: difficulty in fixing dated that are convenient for all (Germany, Cyprus, Greece); it is difficult for policy makers to create ownership of projects' aims and outcomes (the Netherland); conservative educational system (Bulgaria).
- The diversity among the participants' countries (cultural, thematic, applied methodology) is **a big challenge** that should be faced by **flexibility** in future action plans (in terms of methodology, in the target groups' selection and in the focus on the topics). Action plans for realisation of recommendations that emerged from the policy workshops should – at a first level be national/local taking into consideration national conditions.
- Lot of changes and reforms take place in relation to curricula in recent years in most countries. In order **the outcomes and recommendations of the policy workshops** to attract the attention of broader policy audiences – and not be anticipated as short term initiatives that will be out of date in the near future- , they **should be embedded in the frame of broader education priorities** (such as equity, achievement, entrepreneurship) and communicated to the policy makers under such a rationale.

These recommendations are believed to be helpful in the course of **further networking activities with policy makers that have been planned** within the mascil project and especially in the process of **realization of the action plan on how best to involve policy makers into the project endeavour** (Final Policy Paper, due December 2015).

1. National Policy Papers

This part of the document reports on ***the processes and outcomes of the national workshops*** with policy makers that were conducted in the frame of WP2 of the mascil project from ***January 2014 till May 2014*** in ***12 countries*** of the consortium, namely: Germany, Greece, the Netherlands, Spain, Cyprus, Norway, Romania, Czech Republic, Turkey, Lithuania, Austria and Bulgaria.

The 12 national reports provide a detailed account for each national context in terms of: the national policy workshops approach and methodology, the rationale for selection of policy makers and the specific issues for discussion in each workshop, the implementation process and outcomes of the discussions, as well as recommendations that emerged from the discussion on how to achieve the widespread uptake of inquiry-based learning in science and mathematics teaching in rich vocational contexts.

For the ***case of the UK***, due to national elections it was not possible for UK partner to engage policy makers in a policy workshop before June 2015. A statement on the situation in UK is given in detail in one of the chapters in the following.

1.1 National Policy Paper : Germany

Zofia Malachowska & Jochen Schwarz

1. INTRODUCTION

The mascil (mathematics and science for life) project is funded within the 7th framework programme of the European Commission and runs from 2013 to 2017. *mascil* aims to promote a widespread use of inquiry-based science teaching (IBST) and to foster primary and secondary school students' curiosity, engagement and in-depth learning. Project partners are located in 13 European countries: Austria, Bulgaria, Cyprus, Czech Republic, Germany, Greece, Lithuania, Netherlands, Norway, Romania, Spain, Turkey and the United Kingdom. To promote the project, parents, students, school authorities and policy makers are being involved through use of conferences, workshops, publications and round tables. Moreover, mascil aims to clearly show how knowledge gained at schools connects to the world of work at national level. Both inquiry-based science teaching and the connection to the world of work have the goal of making mathematics and science more meaningful to students.

This report on the national policy workshops contributes to the mentioned overall goals of mascil project: a widespread implementation of inquiry-based learning in mathematics and science classes at schools and more and better connections between schools and the world of work.

1.1 Overview of work package 2

Work package (WP) 2 is entitled 'Educational systems and policy contexts'. The overall scope of WP2 is two-fold: *firstly*, it aims to give insights into the strengths, weaknesses, opportunities and threats involved in inquiry-based science and mathematics teaching from a context perspective. *Secondly*, the activities in this WP focus on cooperation and synergies among research, policy and practice fields and producing strategies to support a more widespread implementation of inquiry-based science teaching. To be able to support the goals of the project and the aims of this WP, this national policy paper (NPP) builds on general conclusions and recommendations for policy makers published in the *Cross-national Report and National Policy Paper* (Deliverable D.2.2). In order to generate more concrete discussions on supporting and hindering factors in involving policy makers at the national/regional level in the state of Baden-Württemberg, Germany. Those conclusions and recommendations were contextualised and made more concrete.

1.2 Summary of national policy paper

The national policy paper is centred on questions of high priority for the national and regional context in the Baden-Württemberg area of Germany. These centre on the status of, and conditions for professional development of mathematics and science teachers, connections to the world of work and the current status of inquiry-based learning (IBL) in mathematics and science teaching. The overall scope of this report is to document the planning, implementation, outcomes and main findings of three workshops conducted in January and May 2015.

Therefore, this paper is organised into three main sections. *Firstly*, the approach and methodology of the policy workshops which were carried out on 23 January 2015, 11 May 2015 and 12 May 2015 in Baden-Württemberg are presented. Within this section, also challenges that had to be dealt with during the implementation of the policy workshops are discussed. *Secondly*, the setting and context of the three workshops, as well as their themes, issues and resulting recommendations are presented and examined. Finally, based on the outcomes of the three workshops held, conclusions are drawn in order to engage policy makers in supporting the mascil goals and disseminate the findings of WP2.

2. APPROACH AND METHODOLOGY

The implementation of the German policy workshops is based on the general mascil concept for such and was adapted according to national needs. The specific situation in schools in the federal state of Baden-Württemberg (where the mascil project is implemented in Germany) is characterised by many changes. This contextual situation determined the developed implementation strategy of policy workshops and is the reason why it was decided to run three different workshops, aiming to reach different target groups which are actively involved in the scholar development processes/systems.

In the context of these workshops, the priorities were rather to stress important issues like conditions for high quality professional development (PD) courses and including the elements from the world of work into the day-to-day teaching and to initiate reflection on them than to contest existing school structures and context conditions. We selected the participants and topics for discussion very carefully with respect to the general educational circumstances in Baden-Württemberg.

2.1 Rationale for selection of participants

When selecting the participants for the policy workshops, we attempted to choose the most influential and important stakeholders possible in accordance to the topics of the three policy workshops:

- **Workshop no. 1:** The focus of this workshop was the status of, and conditions for professional development in Baden-Württemberg. The question about how to ensure the high quality of professional development courses was discussed in detail.
- **Workshop no. 2:** In the context of this workshop, we examined questions concerning how to strengthen connections between schools and the world of work.
- **Workshop no. 3:** The third workshop aimed to discuss how to design professional development courses for in-service teachers.

Accordingly, representatives from the regional school authorities were invited to the first workshop. For the second workshop, vocational teachers, teachers from general education, representatives from industry and representatives from parents' associations were asked to participate. Those invited to take part in the third workshop included several researchers, representatives/deputies of the regional school authorities and policy makers responsible for the PD offers on the local level.

2.2 Rationale for selection of specific issues for discussion

By implementing the policy workshops, it was intended to address topics which are currently the most important in the local discourse at schools. During the workshops, it was aimed to initiate reflections on relevant issues that are crucial from our international researchers'/educators' perspective, but have not yet received much attention among policy makers and other educational system stakeholders. Such issues include the acquisition of inquiry-based competences by teachers and/or the establishment of stronger and sustainable connections between schools and the world of work.

The selection of key issues for the workshops was based on the German mascil national report on policy context. We decided to focus on the preconditions of teachers' professional development in Baden-Württemberg and on the challenges and opportunities involved when strengthening the connection between schools and the world of work.

Those topics were revalued by demonstrating their relevance in policy documents and by showing how these are perceived in other social structures and contexts, e.g. industry or economy. To ensure that the workshops produced high quality outcomes and to gain the attention of policy makers and their participation in the policy workshop, it was crucial to offer an interesting, lively discussion on issues relevant to participants' particular field(s) of interest and work.

2.3 Implementation of national policy workshops

In Germany advantage was taken of the opportunity to run several policy workshops and address different target groups. Setting up the workshops according to this concept made it possible to reach most influential people from particular areas of education and thus to ensure the highest possible quality of the workshops.

By these means, the workshops succeeded in achieving extremely valuable outcomes. *First*, the significance of the addressed issues has been emphasised among the participants and the discussion on them has been initiated. *Second*, recommendations resulted that relate to a) teacher professional development and b) establishing connections between teaching at schools and the world of work were elaborated and will be disseminated among the local policy makers. *Third*, in the context of the first workshop a long-term cooperation between local school authorities and the University of Education Freiburg has been formally initiated. In this workshop, the participants agreed to work together towards better quality of professional development courses in Baden-Württemberg. *Fourth*, the German mascil team received new inspiration and motivation for our ongoing and future project work.

2.4 Problem issues that have arisen during implementation

During the implementation of the policy workshops a few challenges occurred that have been overcome successfully.

Due to the particular features of the target groups addressed by the three workshops, there were specific problems in setting the workshop dates. Usually, policy makers' appointment calendars are full and finding a suitable date for most of the desired participants proved to be a challenge.

Additionally, the educational situation in Baden-Württemberg is characterised by reform processes and changes, both in the structures of the school system and in curricula, which made the implementation of the policy workshops challenging.

We managed to overcome these inconveniences by organising target group specific events.

By running three different policy workshops, it was possible to bring together different groups of interest within one meeting. In order to guarantee an adequate flow of information between the different target groups the results from each workshop were reported to the participants of the subsequent meetings. We are convinced that under the given circumstances, this implementation strategy was the best approach to gaining the most valuable outcomes.

3. DOCUMENTATION OF WORKSHOPS

In the following, detailed information about the workshops is provided. First, the setting and context of the workshops are described. Second, the addressed topics and issues are introduced. Third, the elaborated recommendations for the policy makers are incorporated.

3.1 Setting and context of national policy workshops

All workshops took place at the University of Education in Freiburg. In order to reach as many people from the desired target groups as possible it was beneficial to connect the mascil policy workshops to other events.

The **first workshop** lasted two hours and was part of a meeting of representatives of school policy from Baden-Württemberg and researchers from the University of Education in Freiburg. A representative of the regional educational authority, seven representatives of the subordinated school authorities and seven researchers from the University of Education in Freiburg participated in this workshop.

The **second workshop** took one hour and was included in a meeting of the mascil national advisory board. A vocational teacher, a teacher from a secondary school, an entrepreneur, a representative of a parents' association and a number of members of the German mascil team were present at this policy workshop.

The **third workshop** lasted two hours and was integrated into a meeting for planning and designing a large professional development event for approximately 200 in-service teachers. Seven representatives of regional school authorities, six researchers from the University of Education and three members of the German mascil team participated in this workshop.

Each workshop offered the participants a particular possibility to discuss current, highly relevant issues and in some cases, even to reach very concrete agreements.

During these meetings, the German mascil team took particular care to ensure that the atmosphere remained casual and amiable. In this way, the participants felt free to express their opinions and the ambience encouraged the unconstrained exchange of ideas/opinions and stimulated lively debates.

3.2 Themes and issues discussed

In the context of each policy workshop, the focus was placed on one special topic:

The **first policy workshop** (in which the local school authorities and researchers participated) focussed on the quality of professional development courses. The structure of the existing PD courses was discussed in detail in order to find out which conditions ensure the best possible outcomes and which structure model should be followed in future PD courses. Workshop participants addressed the following parameters: PD course length, group composition and continuity.

A special focus was on the quality of the preparation of the people in charge, meaning those who commission the professional development courses and make decisions about the main topics/structure of the PD, as well as the educators who carry out the courses. The question of what knowledge and preparation such people should hold in order to ensure the highest quality of teachers' education was discussed extensively.

Furthermore, there was a lively discussion about how policy and science/research can and should cooperate to reach the aim: a widespread implementation of inquiry-based teaching. Participants extensively exchanged ideas on how to best support teachers' acquisition of basic, content-oriented competences and inquiry-oriented competences.

It became obvious that there is a big discrepancy between teachers', researchers' and policy makers' perceptions related to the issues that should be broached at professional development courses. Participants agreed that all perspectives should be taken into account when designing professional development courses.

During the **second policy workshop**, the main topic addressed was the connection between schools and the world of work. The participants dealt with the issues of how this connection currently appears in the local environment - and how different key players can more strongly support the cooperation between schools and industry/economy with the aim of ensuring that school students will have the most optimal start into their future, professional lives.

Participants pointed out the crucial role of information transfer between the groups concerned. According to the participants of this workshop, the knowledge about existing professions and possible professional training pathways is very poor – not only among students, but also among their teachers and parents. These last two groups were identified as key players in the processes of making decisions related to young people's professional future. It was agreed that there is a need for more and better communication between parents, teachers and representatives of the industrial and business sector in order to provide school students with a real perception of what the current world of work looks like.

Additionally, participants stressed that information about the world of work should not only be integrated into the curricula, but also be part of teachers' day-to-day teaching practice and PD. Increasing the cooperation between vocational schools and general schools was another issue participants in this workshop addressed.

Within the second policy workshop, a particular focus was on structural obstacles that hinder teachers from including world of work elements into their day-to-day teaching - and on possible solutions for this situation. The teachers present at the second workshop emphasised that the culture of changes that has been dominating the

school policy for several years now, contributes to teachers having an overall attitude of mistrust and a lack of teacher engagement/initiative.

Moreover, participants mentioned that it is important to be aware of the effects of the noticeably one-sided orientation towards *Gymnasium* (the highest form of secondary school in Germany) and in the next step to academic studies and professions. It has to be realised that this trend also changes the image of the vocational education and training sector and also that of technical professions. Participants expressed their concern related to this increasing trend in the recent past and a possible devaluation of non-academic professions.

An additional feature of the second workshop was a lively discussion on competences currently demanded by the labour market. The representatives of the industry who attended this workshop stressed that in particular, small and medium-sized enterprises need employees with a high degree of ability and capacity to learn. They are looking for trainees and employees who have interest and curiosity, and are deployable in diverse positions in order to manage the day-to-day challenges found in the increasingly complex and dynamic business world.

The focus of the **third policy workshop** was planning and designing a large, whole-day professional development event for approximately 200 in-service teachers. Invited participants included low and high-level regional school policy representatives as well as researchers from the University of Education in Freiburg.

During this workshop there was initiated a process of selecting the most relevant topics for professional development. The researchers mainly stressed the importance of inquiry-based approaches to teaching and learning. The representatives of school authorities focused more on the basic competences included in curricula and on classroom challenges, such as dealing with diversity.

Participants also addressed preconditions for successful professional development during the workshop. This discussion included challenging issues like gaining teachers for PD courses or overcoming the structural obstacles.

3.3 Recommendations

Quality of teachers' professional development

In order to ensure the highest possible quality of teachers' professional development, the people in charge of PD courses – both policy makers who commission the courses and the educators who carry them out – should be best prepared and possess knowledge about new relevant approaches and concepts.

The programme of PD courses should be designed in cooperation between researchers and representatives of educational policy. Teachers' perspective should also be taken into account by those who are designing processes. Only such interactive processes guarantee that all important issues will be included into professional development.

In order to gain participants for PD courses, it is necessary to ensure that teachers receive the best possible structural conditions, such as the possibility of being permitted to be absent from school for the duration of the PD courses, as well as financial compensation for covering the costs incurred in connection with their participation in PD courses.

It is preferable to offer long-term professional development courses that take place on a regular basis. Reflection phases between meetings allow for participants' knowledge acquisition and help the teachers to elaborate good practices. It is desirable to guarantee the continuity of the learning community so that after completing a PD course, participants can benefit from the gained confidence and the social network on a long-term basis.

Content of professional development courses

The programme of teachers' professional development needs to be designed in respect to teachers' needs and also take into account requirements of the world of work. The current academic perspective should implicitly be considered as well. The ongoing dialogue between key groups and stakeholders should be initiated and continued.

A balance between basic content-oriented competences and inquiry-based competences should be maintained.

Initiating communication processes between different interest groups

Career perspectives and vocational competences are rarely addressed in schools - respectively in classrooms. A reason for this is that the key players – teachers and parents – often have insufficient knowledge regarding possible vocational and scientific opportunities and orientations.

Therefore, there is a need for networking between the different groups (general teachers, vocational teachers, teachers of different educational levels, parents, industry and business representatives) and for distributing information between these groups. Initiating communication processes should help decision-makers (parents and students) to recognise a particular student's qualifications and career possibilities in order to make an optimal decision regarding their future profession.

The distribution of knowledge about qualifications and career possibilities should be integrated into the programme of teacher training sessions. It is especially important to familiarise teachers in initial teacher education with diverse possibilities of professional careers.

Reevaluation of non-academic professions

It has been apparent for some years now that there is a tendency among German school students to choose *Gymnasium* instead of the other available forms of secondary schools (*Hauptschule* and *Realschule*), and then go on to study at college or university instead of doing professional training in a dual system that combines work experience with course work. This trend leads to a shift away from technical/manual professions, and in consequence to a shortage of skilled labour forces. This structural development leads to an increasing risk for the continued existence of many small businesses, especially in specific sectors of industry.

It is necessary to reevaluate non-academic professions and to convey the attractiveness of vocational education and training to key players – teachers, parents and students. A new image of these professions is essential in order to meet economic and industrial requirements. The structural changes in the world of work and the labour market should be taken into consideration when designing curricula - especially for mathematics and science education.

Incorporating career guidance into the educational curriculum

The world of work is increasingly moving faster and becoming more dynamic and complex. Schools should take the new requirements of the world of work into account

– and when doing so, realise that it is not sufficient to simply include vocational competences in the curricula. In order to emphasise the high significance of vocational competences, specifications for their implementation and appropriate measures for assessing them should be integrated into the curricula as well. Necessary time-related and people-related conditions to bring vocational references into classes and include significant elements of vocational orientation in schools and day-to-day teaching have to be created. The possibility of carrying out extracurricular, interdisciplinary, cooperative projects in cooperation with external institutions should be open to all schools and at all school levels.

4. SUMMARY AND CONCLUSION

In January and May 2015, three national policy workshops were conducted at the University of Education Freiburg. The approach and decision to connect the workshops to other events and hold small workshops on topics tailored to selected groups of interested participants turned out to suite the current situation in Baden-Württemberg and worked very well. Whereas the goals of the workshops were very precise, having three workshops resulted in obtaining a heterogeneous group comprised of different levels in Baden-Württemberg, Germany. Policy makers, researchers, general and vocational education teachers, school authorities, representatives from parents' associations and representatives from small and medium-size enterprises in Baden-Württemberg were reached and all these participants from the diverse perspectives joined the vital discussions. The German mascil team was able to address most relevant topics, recommendations and conclusions of the national policy report, and discuss ways to ensure more and better connections to the world of work, conditions for high quality PD courses and a widespread implementation of IBL in mathematics and science teaching.

As an outcome of the workshops the following findings and crucial success factors have to be taken into account in order to ensure the envisaged goals of the mascil project:

- Ensure high quality teachers' professional development in long-term courses: In order to foster teachers' willingness to participate in PD courses, they need to be informed and updated about evident research findings that show how they can personally benefit from PD participation. When it comes to the actual structure of PD courses, these should be long-term, situated in transparent context conditions under clear guidelines and designed on the basis of teachers' needs. In addition, the establishment of professional learning communities should be fostered in order to maintain stimulated communication both during and after PD courses.
- Initiate communication processes between different interest groups: So far, learning processes in the classroom are rarely centred on competences needed by the labour market and the world of work. To illustrate the benefit of a closer connection between schools and the world of work, existing networks and relationships should be revitalised and expanded. Moreover parents and especially teachers, have to be appropriately informed about career perspectives with academic and non-academic qualifications. Hence, opportunities of connections with the world of work should be part of teacher training programmes.

- Reevaluate non-academic professions: To serve the needs of young people and society, it is very important that parents, teachers and students themselves also take into account the strengths and opportunities of working in the non-academic sector. Expanding and reconsidering how we view such non-academic careers - and underlining the benefits of such professions are important steps towards achieving this goal.
- Integrate career guidance in curricula: To be able to react to world of work dynamics and suitably prepare students for the labour market, it is important to integrate more and better connections to the world of work into the learning processes in day-to-day teaching, as well as into the curricula. Therefore, schools should offer extracurricular projects conducted jointly with external institutions.

While reviewing the national policy workshops in Baden-Württemberg, Germany, the mascil team was able to successfully address most relevant topics contained in the national policy report and discuss them with different target groups. Conducting three national workshops with policy makers and stakeholders allowed debate that identified most relevant challenges and opportunities from different perspectives. One of the highlights and outcomes of the workshops is the establishment of a long-term cooperation concerning PD courses between the Regional Council in Freiburg (*Regierungspräsidium*), state seminars for didactics and teacher training from Constance, Donaueschingen, Lörrach, Freiburg and Offenburg, and the University of Education in Freiburg. The partners agreed to cooperatively design and conduct a long-term professional development course comprised of several meetings and lasting for about one year.

There are still challenges and factors like structural conditions that hinder more and better connections between schools and the world of work. The discussions and reflection on possible obstacles initiated by the national workshops at different levels underpin the need to build on existing connections and use them more systematically – and also underline the need to establish new and sustainable ones.

To date, only a few stakeholders and policy makers have focussed on the relevant aspects of societal benefits and the enrichment for teachers and students. Reaching and convincing more policy makers and school authorities is an important and necessary step. Therefore, piloting projects on specific topics with selected small and medium-size enterprises could support those goals and reduce existing reservations. Moreover, involved participants highlighted the necessity for more and better connections to the world of work with reference to changes in the labour market and the needs of society. At the same time, it was made clear that initiatives like the national policy workshops are essential to appropriately support and frame ongoing processes of change. Participants were aware of the necessity of fostering IBL in science teaching - and of having high quality PD courses which integrate dimensions and competences required by the labour market and that are based on the needs of teachers. It was pointed out that such initiatives are helpful and needed for the exchange of ideas, to intensify existing networks and when talking about ways and possibilities of approaching set goals.

Finally, widening the scope of workshops and involving more interest groups (for example through use of round table discussions) would greatly contribute to achieving our aims. Such workshops/roundtables would be beneficial when it comes to informing stakeholders, encouraging exchange about existing opportunities and in

appreciating the future value of having strong and stable connections to the world of work within curricula and schools in general. We are convinced that these and the other measures and recommendations contained within this report are all valuable means of supporting us as, step by step, we strive to achieve mascil's given goals.

Appendix 1

Workshop No.1

23 January 2015

List of participants

Christina Orth-Dobler Regional Council Freiburg

Helios Scherer State Seminar for Didactics and Teacher Training Lörrach

Hermann Maier State Seminar for Didactics and Teacher Training Freiburg

Rafael Rauscher State Seminar for Didactics and Teacher Training Freiburg

Wolfgang Zink State Seminar for Didactics and Teacher Training Offenburg

Andrea Müller-Janson State Seminar for Didactics and Teacher Training
Donaueschingen

Gerhard Liehner State Seminar for Didactics and Teacher Training Donaueschingen

Konrad Fritz State Seminar for Didactics and Teacher Training Konstanz

Katja Maaß University of Education Freiburg, Institute for Mathematics Education

Timo Leuders University of Education Freiburg, Institute for Mathematics Education

Lars Holzäpfel University of Education Freiburg, Institute for Mathematics Education

Petra Gretsch University of Education Freiburg, Institute for German Language and
Literature

Silke Milkelskis Seifert University of Education Freiburg, Institute of Chemistry,
Physics, Technology and their didactics

Jens Friedrich University of Education Freiburg, Institute of Chemistry, Physics,
Technology and their didactics

Ulrike Spörhase University of Education Freiburg, Institute of Biology and its didactics

Workshop No.2

11 May 2015

List of participants

Solveig Bürkle teacher of general education at the Kepler Gymnasium Freiburg

Thomas Reiner vocational teacher at the Gertrud- Luckner-Gewerbeschule

Michael Schönhardt SSS Siedle company

Katharina Gamerdinger Parents' Council Freiburg

Katja Maaß University of Education Freiburg

Jochen Schwarz University of Münster

Karen Reitz-Koncebovski mascil project
Anika Weihberger mascil project
Zofia Malachowska mascil project

Workshop No.3

12 May 2015

List of participants

Lars Holzäpfel University of Education Freiburg
Stefan Eigel State Seminar for Didactics and Teacher Training Lörrach
Carmen Lohrmann State Seminar for Didactics and Teacher Training Offenburg
Christina Orth-Dobler Regional Council Freiburg
Timo Leuders University of Education Freiburg
Rafael Rauscher State Education Authority Freiburg
Frank Föckler University of Education Freiburg
Jochen Schwarz University of Münster
Karen Reitz-Koncebovski mascil project
Katja Maaß University of Education
Zofia Malachowska mascil project
Gerhard Metzger State Seminar for Didactics and Teacher Training Freiburg
Pia Pilgrim State Seminar for Didactics and Teacher Training Freiburg
Jürgen Kury State Seminar for Didactics and Teacher Training (vocational schools)
Freiburg
Sabine Kowalk University of Education Freiburg
Reinhold Haug University of Education Freiburg

1.2 National Policy Paper : Greece

Foteini Chaimala & Kathy Kikis-Papadakis

1. INTRODUCTION

In recent years, the European policy agenda has prioritised the *promotion of equity*, the *enhancement of students' achievement* and the *promotion of entrepreneurship* (EC Communication, 2012). With a view to addressing these challenges, educational policy discourse has focused on the promotion of *inquiry-based learning and teaching approaches*, on *opening schools to the world of work* and on *ensuring high quality teaching* through effective initial teacher education and continuous professional development. In the course of these developments, *the mascil project strives to contribute towards* a widespread uptake of inquiry based approaches in primary and secondary science and mathematics education and establish connections between inquiry-based learning (IBL) and the world of work (WoW). Among the activities conducted within the project, work implemented in the project's *Work Package 2 (WP2)* focuses on *establishing cooperation and synergies and foster consensus building among research, policy and practice fields* with the view of supporting the widespread uptake of IBL in the context of WoW from a policy perspective.

1.1. Overview of work package 2

One of the main **goals of workpackage 2** (WP2) of the mascil project is to **initiate a dialogic process with policy makers** at national and European levels, aiming to make out and remove obstacles and tare possibilities of cooperation and synergies between circles of research, policy and practice **in order to promote of inquiry based learning in the world of work context**. To address this objective, **previous work** within WP2 (see D2.1 National working papers on analysis of policy contexts) provided **a detailed account of policy contexts in the 13 European countries** of the consortium under the scope of investigating the contextual and regulatory conditions under which teachers are called to implement (or not) inquiry based and context based approaches to their teaching. Information provided in the 13 national working papers were then synthesized and analysed, with an aim to identify differences and commonalities among the participant countries and to **provide recommendations to inform the development of future policy in national and European settings** (see D2.2 Cross-national report and policy paper). **The current work** builds on the general conclusions and recommendations for policy makers published in D2.2, by reporting on **the processes and outcomes of the negotiation with national policy makers in Greece on how these conclusions and recommendation can be more effectively contextualized and put more concrete at a national level**. Outcomes of current report will feed **further work within WP2** relating to the analysis of the outcomes of the policy workshops in all countries and the production of policy recommendations and action plan on how best to support inquiry based learning approaches in world of work contexts (Deliverable 2.4, due December 2015).

1.2 Summary of national policy paper

This paper reports on the planning and the implementation of the Greek policy workshop that took place in the frame of the second workpackage (WP2) of the mascil project. The main aim of the workshop was to engage policy stakeholders in Greece in a process of reflection and negotiation on issues relating to IBL and WoW in the country and to acquire new perspectives from them on how to make more effective connections between science and math education with the WoW via IBL approaches. The paper starts with an overview of the approach and workshop methodology, providing the rationale for the selection of policy stakeholders and specific topics for discussion. Following this, it provides a detailed account of the implementation process (activities in the sessions; linking objectives, sessions, and expected outcomes) and on the obtained outcomes in relation to the objectives of each session. The paper concludes with a summary of the implantation process and outcomes and provides links on how this work contributes to broader aims of the mascil project.

2. APPROACH AND METHODOLOGY

The planning and the implementation of the Greek Policy Workshop was based on the general mascil concept for conducting policy workshops (see Appendix 1 of the deliverable), under the scope of achieving the following **aims**:

- **To engage** relevant stakeholders in the process of **reflecting** and **negotiating** on prominent issues in the field of IBL and the WoW in the country;
- **To acquire valuable new perspectives** from stakeholders' contributions, in terms of what can be done at national/international levels to motivate policy to support inquiry-based approaches in science and math education in a world of work context.

The accomplishment of these aims is believed to contribute towards fostering consensus building among policy, research & practice field - in the view of supporting the widespread uptake of IBL in the context of WoW- which is the **broader purpose** of WP2 of the project under which this work is framed.

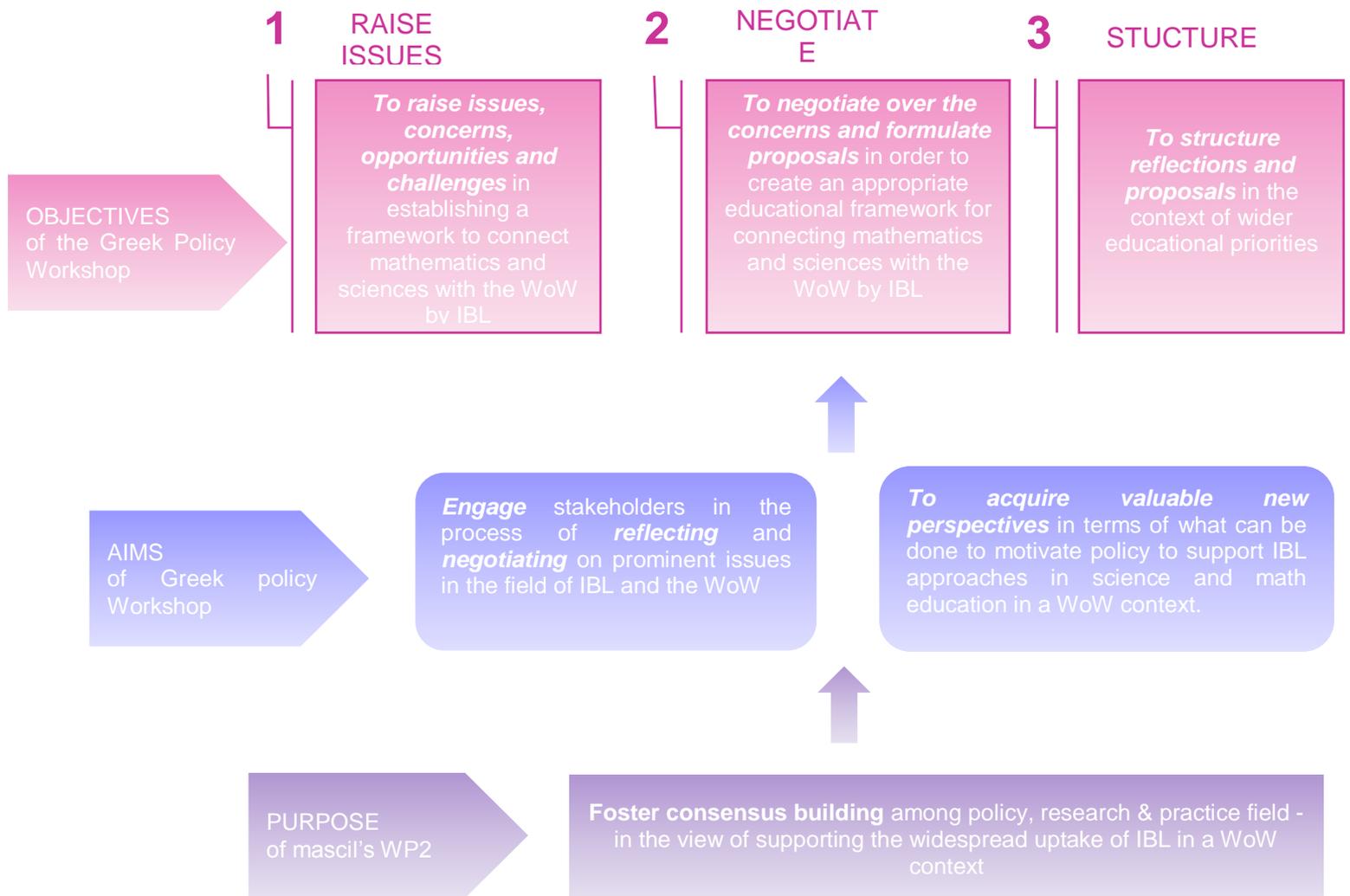
The methodological approach for conducting the Greek Policy Workshop was guided by the cross-national method of analyzing the educational contexts within the project (documented in D2.2), which provided conclusions and recommendations under three dimensions of analysis: **a) Thematic-oriented dimension** (in terms of IBL, WoW and CPD); **b) Systematic-oriented dimension** (in terms of macro-, meso-, micro- educational levels) and **c) Strategic Priority – oriented dimension** (in terms of broader educational policy priorities). In line to the dimensions of analyzing the educational systems and policy contexts, the Greek Policy workshop was structured under three sections (Thematic-oriented session; Systematic oriented session; Strategic priority session), with the view to achieve accordingly the following objectives (**Greek Policy Workshop Objectives**):

- **To raise issues, concerns, opportunities and challenges** in establishing a framework to connect mathematics and sciences with the WoW by IBL methodology (Thematic oriented session);

- **To negotiate over the concerns and formulate proposals** in order to create an appropriate educational framework for connecting mathematics and sciences with the WoW by IBL methodology (Systematic oriented session);
- **To structure reflections and proposals** in the context of wider educational priorities (Strategic priority session).

Figure 1 below provides an overview of the purpose, the aims and the specific objectives of the Greek Policy Workshop

FIGURE 1: The purpose, the aims and the objectives of the Greek Policy Workshop

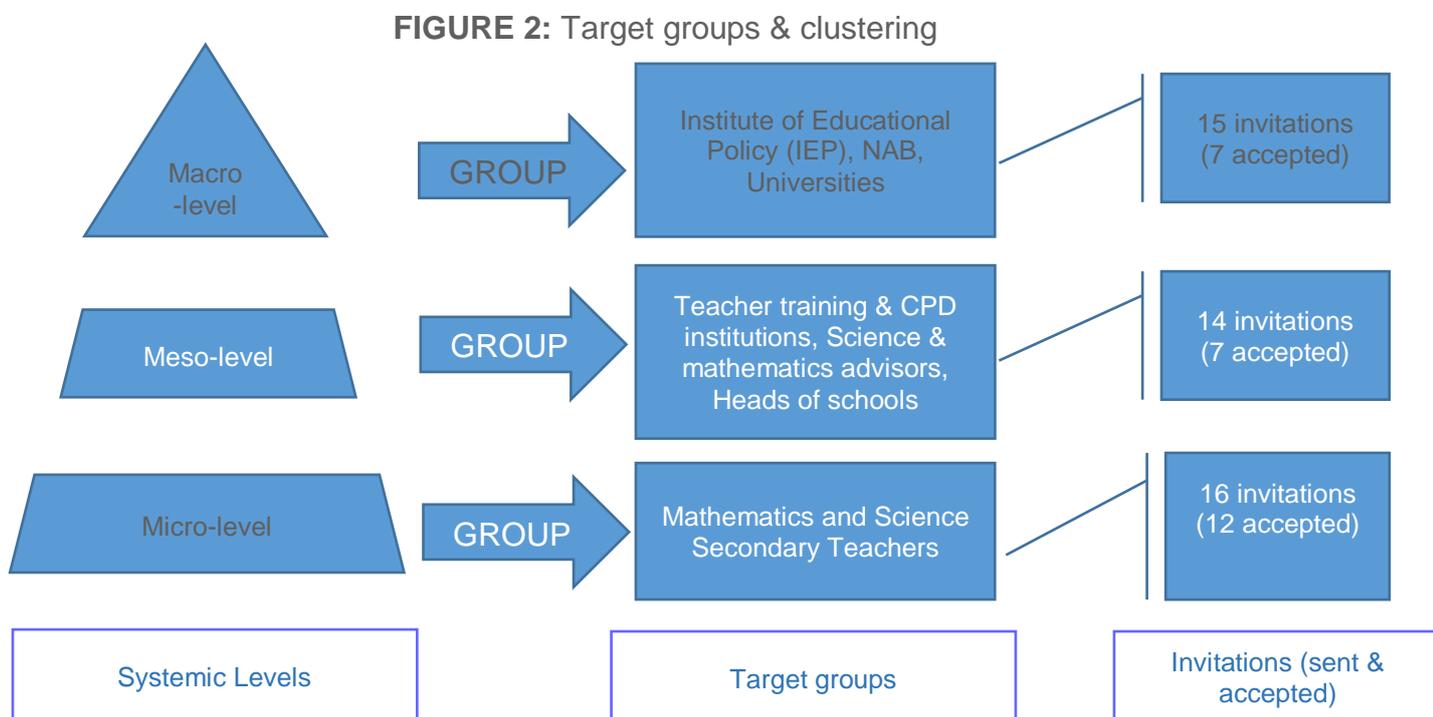


For achieving its objectives the Greek Policy Workshop followed a **European Awareness Scenario Workshop (EASW) setting**, according to which participants - in working groups of varying composition and in plenaries - develop scenarios on the workshop topics, name barriers and propose strategies and steps for realizing the goals and overcoming the barriers. Building on concrete “scenarios” or problem constellations, it invites working group members to think about realistic challenges rather than dreaming up unlikely problems and solving them. Such a workshop follows three phases - the critical analysis phase, the visionary phase and the implementation phase – “to create a basis for local action”. The EASW setting **allows**

for interaction between stakeholders - rather than in which presentations are provided to participants and **aim for consensus building rather than instructional approach**. One disadvantage of EASWs is their reliance on stakeholder balance, which might never be reached realistically. However, targeting a certain number of distinctive stakeholders is a good starting point to make “bringing together a broad range of interests” a little more concrete.

2.1 Rationale for selection of policy makers

In line to the general mascil concept for conducting policy workshops (see Appendix 1), a wide definition of “policy makers” was adopted, which includes people from the **macro-educational level** (in high-level positions related to educational policy), the **meso-educational level** (people who mediate policy envisions to practitioners) and the **micro - educational level** (implementers of policy orientations). The involvement of stakeholders from all educational levels was decided so as to support the EASW setting of our workshop and to allow the negotiation of issues and concerns in a democratic basis with an aim for consensus building. The following figure (Figure 2) illustrates the target groups of the participants and their clustering from a systemic-levels point of view.



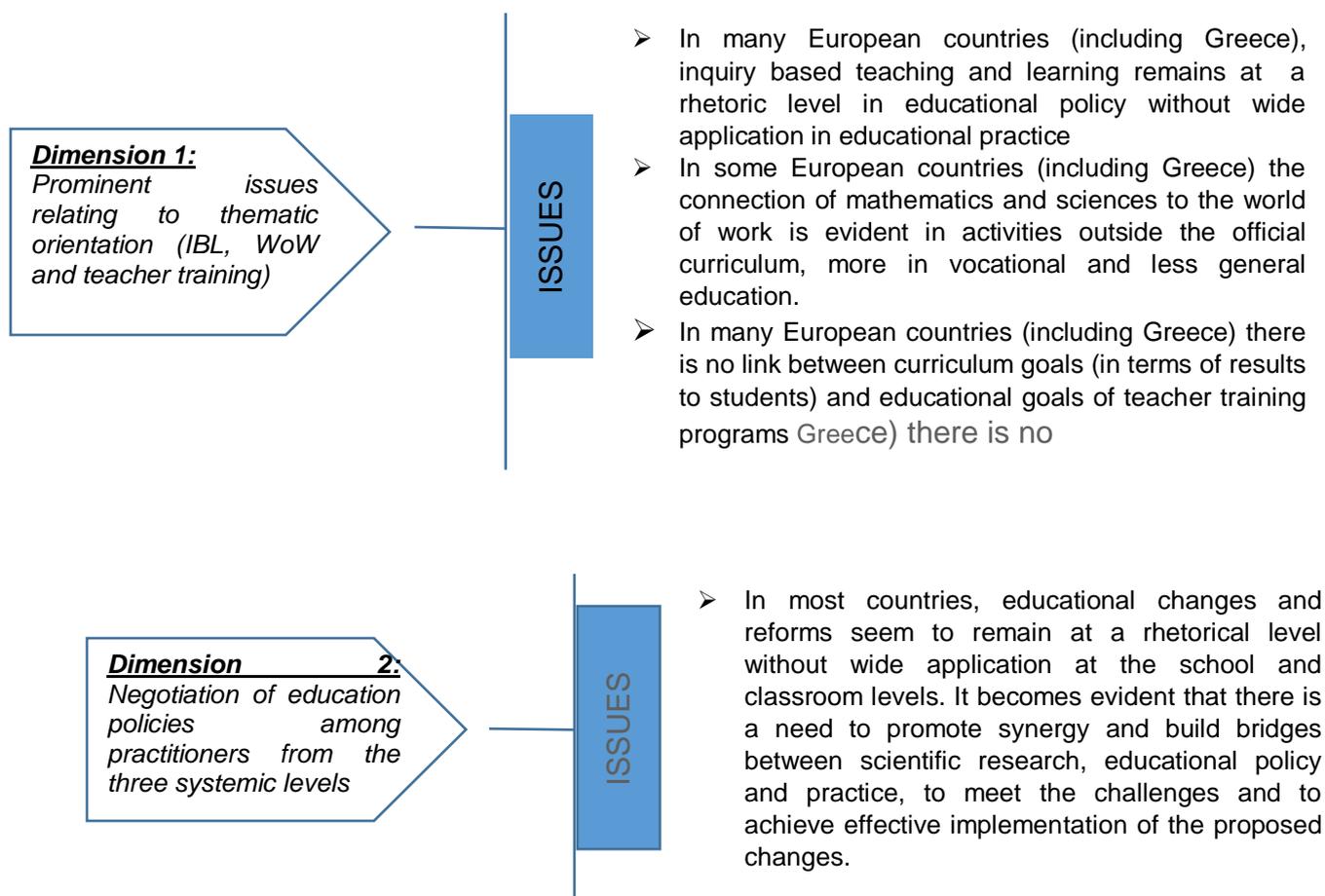
In the process of recruiting participants, we draw on our existing connections with stakeholders from: the Greek Institute of Educational Policy (IEP) which is under the auspices of the Greek Minister of Education; Universities and Institutions that provide initial teachers training and continuous professional development (University of Athens, Panteion University, ASPAITE); the Directorate of Secondary Education in Athens (for recruiting mathematics and science advisors); the network of Experimental schools; the National Advisory Board (NAB) of the mascil project; mascil network of secondary math and science teachers.

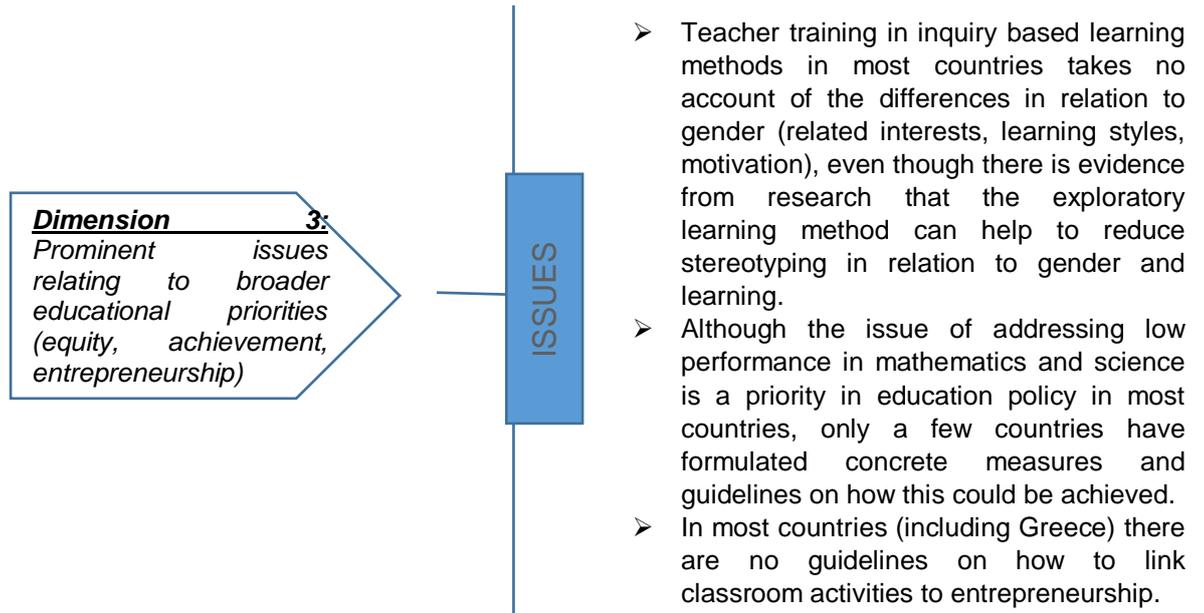
In total ***we invited 45 people*** (15 from the macro-level, 14 from the meso-level and 16 from the micro-level) out of which ***26 people accepted the invitation*** (7 from the macro-level, 7 from the meso-level and 12 from the micro level) and ***25 participated***.

2.2 Rationale for selection of specific issues for discussion

For the selection of key issues for the policy workshop we referred to the Greek National report (see D2.1) and the Cross-National analysis of policy contexts report (see D2.2) of the mascil project. We focused on three dimensions -and relating important outcomes of the reports-, in accordance to the three objectives of the workshop (raising issues- negotiating-structuring): Dimension 1: Prominent issues relating to thematic orientation (IBL, WoW and teacher training); Dimension 2: Negotiation of education policies among practitioners from the three systemic levels; Dimension 3: Prominent issues relating to broader educational priorities (equity, achievement, entrepreneurship). The following figure (Figure 3) illustrates the ***important key outcomes of the mascil reports*** (D2.1 and D2.2) which provided the background for the discussions during the workshop sections.

FIGURE 3: Key issues from the mascil reports (D2.1 & D2.2) that provided the background for discussions





The key issues/outcomes of the cross-national analysis of policy contexts in the mascil project were communicated to the participants before the workshop as background information – Briefing Paper sent to the participants a week before the workshop (see Appendix in the Greek report) – along with the agenda (see Appendix in the Greek report) and provided the basis for the discussions that took place during the actual implementation.

2.3 Implementation of the Greek policy workshop

The Greek national workshop followed an adaptation of the European Scenario Workshops (EASW) setting; the core of it was structured in three sessions/phases in accordance to the three main objectives that we wanted to achieve:

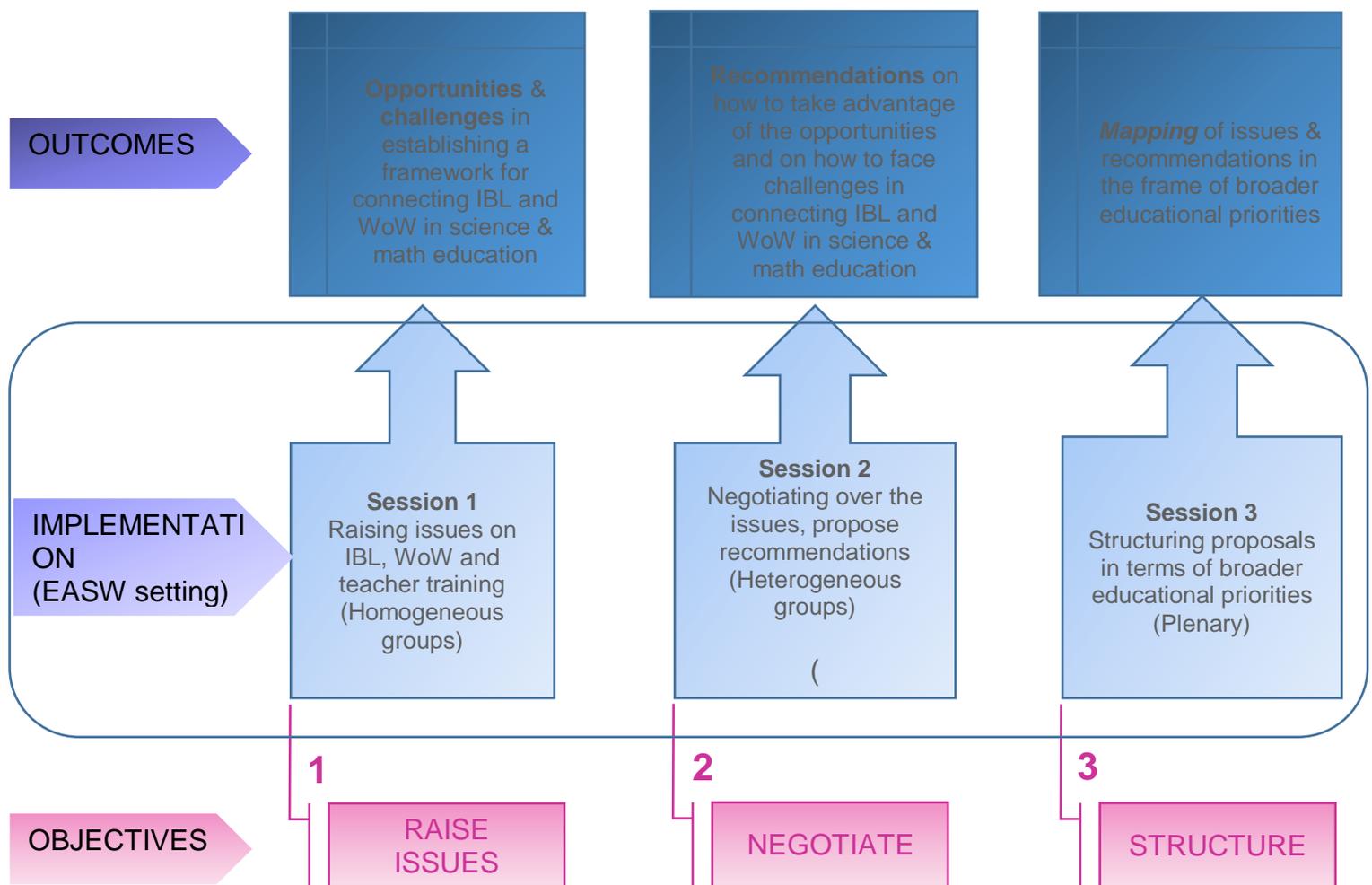
- **Session 1** focused on *raising issues relating to IBL, WoW and teacher training* and aimed at achieving the first of our objectives (see figure 1). In this session, the participants were divided in **3 homogeneous working groups** as described in Section 2.1 of this report (Group 1: Participants from macro-educational level; Group 2: Participants from meso-educational level; Group 3: Participants from micro-educational level). Participants were referred to the key issues of the cross-national analysis that were communicated to them via the Briefing Paper before the workshop. **Each participant** was asked to write down in a green card **opportunities** and in a red card **obstacles/challenges** in the country for a) the connection of science and mathematics with the WoW; b) widespread implementation of IBL approaches and c) teacher training on connecting science and mathematics with the WoW via IBL approaches. Following this, participants shared their views within their group, discussed and agreed on the **common group views in terms of opportunities and challenges in the country for establishing a framework in the country for connecting science and mathematics education with WoW via IBL**

approaches. Key outcomes of each group discussions were written down in posters (one poster per group) and were communicated in the plenary.

- **Session 2** focused on the **negotiation over the issues** that emerged from the previous discussions, with the view to **formulate recommendations on how to take advantage of opportunities and how to face challenges** in the process of connecting science and math education to the WoW via IBL (linked to the second objective, see figure 1). Participants were divided in **3 heterogeneous working groups** (mixed-groups, with participants from the three systemic levels): Group A: discussed on IBL in science and math education; Group B: discussed on connecting WoW to science and math education; Group C: discussed on the thematic of teacher training in terms of IBL and WoW). Each group was asked to focus on the opportunities and challenges that were formulated in the previous section according to the group thematic (IBL/WoW/teacher training) and negotiate with the group participants on how to take advantage of the opportunities and how to overcome difficulties. Discussions in this session resulted in **3 sets of recommendations on:** a) how to **promote IBL** in the country; b) how to **connect more effectively IBL and WoW** in science & math education; c) how to **provide effective teacher training** in terms of IBL and WoW. At the end of this session, recommendations were written down in posters (one per group) and were communicated in the plenary.
- **Session 3** aimed at **structuring** the **issues** raised and the **recommendations** emerged in the previous sessions, **in terms of broader educational priorities: equity, achievement and entrepreneurship.** Discussions took place in the **plenary** around the question: “Could the connection of science and math to the WoW via IBL approaches be a vehicle towards meeting broader educational priorities, such as equity, achievement and entrepreneurship? How?” Participants were engaged in an unstructured discussion around the questions and key points from the discussion were written down in a poster in the form of bullet points by the facilitator.

The following figure (Figure 4) provides an overview of the implementation of the Greek policy workshop, linking objectives, sessions, and expected outcomes.

FIGURE 4: Sessions of the EASW policy workshop, in relation to objectives and outcomes



2.3 Problems/issues arisen during the implementation

In the **process of planning** the Greek Policy workshop the main challenge we faced was in terms of **ensuring balanced participation** from the three groups of stakeholders, which is important for supporting the EASW setting. Our **connection with IEP** (key person Dr. Yannis Roussakis) was very helpful in reaching stakeholders from the macro and meso educational levels, while our **mascil partners from the University of Athens** (Prof. Despina Potari and Dr. Giorgos Psycharis) helped in recruiting participants from the meso and micro educational levels. As evident in Figure 2 we faced successfully this challenge and **managed to recruit participants in a rather balanced participation** (7 participants from the macro-level, 7 participants from the meso-level and 12 participants from the micro level). **The risk of non-showing** despite accepting invitations was taken into consideration, so we decided to communicate with the people that had accepted our invitations 2 days before the event sending them the agenda and background materials (Briefing

paper, see Appendix in the Greek report). **Out of the 26 people who had accepted our invitation only 1 person did not showed up.**

In the **process of implementation** the main challenge we faced was in terms of putting into practice effectively the EASW setting, which requires **active involvement** by the participants – in contrast to more instructional workshop approaches. Especially in the phase of negotiations (mixed-group) and in the plenary there is a risk that participants do not succeed to communicate effectively with people from different positions and do not manage to come up with commonly shared recommendations and solutions. We faced this challenge by **recruiting a skilful workshop facilitator** (Anna Anastasopoulou), while Dr. Andreas Kollias from our team provided great help during the plenary session in terms of managing discussion and consolidating issues and views from the participants.

3. DOCUMENTATION OF THE WORKSHOP

In the following detailed information about the Greek Policy Workshop is provided. First, the setting and the context of the workshop is described. Second the outcomes of participants' discussion in relation to the 1st Session (raising issues in terms of IBL, WoW and teacher training in the country) are provided. Recommendations on how to take advantage of opportunities and how to overcome difficulties are then incorporated, as resulted from the 2nd Session of the workshop. Finally, the outcomes of the effort to structure issues in terms of broader educational priorities is provided (3rd Workshop Session).

3.1 Setting and Context of the Greek Policy Workshop

The Greek Policy Workshop took place on the **15th of May 2015**, at the **Department of Mathematics, University of Athens**, with the participation of **25 stakeholders in the working groups** (out of 26 who had accepted our invitation). As it had been scheduled according to the agenda (see Appendix of the Greek National Report) the workshop started **at 10:30 am** and **finished at 4pm**. From the beginning of the meeting till the end the atmosphere was very positive and the participants were engaged in lively discussions on the topics.

3.2 Raising issues - outcomes of the 1st Session

The main objective of the 1st session of the workshop was to raise issues, concerns, **opportunities** and **challenges in establishing a framework to connect mathematics and sciences with the WoW by IBL**. Three homogeneous groups were formed (with participants from the macro, meso and micro educational levels in each group) which provided us the following feedback:

Group 1: Stakeholders from the macro-level (policy makers)

Participants in this group **focused more on the opportunities** in the country for connecting math and sciences to the WoW via IBL approaches and put emphasis on dimensions of the **new educational reform and on current curriculum**

developments, arguing that they provide a fruitful context for connecting WoW to science and math and for implementing IBL approaches. In terms of **challenges**, they raised the issues of the **role of teachers** and educators, their culture towards change & the training they have received; issues of **assessment** and **strict curriculum requirements** were also mentioned. It is important to note that during their presentation they emphasized that **they view challenges under the scope of how these can be transformed to opportunities**, rather than difficulties and barriers that cannot be confronted. In specific, the poster of this group contained the following points:

Opportunities:

- The new education reform for Upper Secondary School (“theory and practice”)
- Formulation of the “mathematics laboratory” in schools
- The example of the new curriculum for Physics, 1st Grade of the lower secondary school
- Experimental Schools, formation of Subject Clubs in Schools
- Teachers’ professional development at school level
- New curricula
- Extra-curriculum activities
- Insecurity in terms of occupations → Opportunities for lifelong education
- Need to understand sciences

Challenges:

- Importance of connections between Tertiary Education (teachers training and CPD) and Schools
- The character and the content of Upper Secondary School Studies (Exams for entering Universities – expectations from society and curriculum – directions of curriculum and textbooks)
- Educators’ reluctance to change and reforms, but also the need to respond to the requirements
- Teachers’ pedagogical training
- Conflict between inquiry-based learning approaches and strict curriculum
- Difficulty in connecting world of work to science and math education
- Difficulty in assessing inquiry based learning approaches (this is also an opportunity).

Group 2: Stakeholders from the macro-level (policy mediators)

Participants in this group **started with the challenges** in the country for connecting math and sciences to the WoW via IBL approaches. In line to the views of the previous group (policy makers), they raised the issues of the **strict curriculum** that does not allow in practice implementation of IBL approaches –which in their view requires flexibility- and of the **assessment** system. In relation to the **opportunities**, they focused more on helpful **aspects of the current educational system**, rather than referring to the new educational reforms. It should be noted that when presenting both challenges and opportunities, **the important role of mediation, connection**

and **cooperation** was highlighted. In specific, the poster of this group contained the following points:

Opportunities:

- Projects Work in Schools
- Experiential and hands-on activities
- Subject Clubs in Schools
- Cross-thematic approach of teaching
- New technologies in schools
- Visits to sites of WoW
- Involvement of school in European Research Projects

Challenges:

- Strict curriculum requirements
- Assessment
- Lack of training & opportunities for professional development
- Lack of a “cooperation culture”

Group 3: Stakeholders from the micro-level (policy implementers)

Participants in this group shared views with the policy-mediators group in most of the **opportunities** they raised: project works, subject clubs, new technologies, while they added **the connection of general with vocational schools**. In relation to **challenges** and in line to the views of policy-mediators, they focused on the **lack of cooperation culture** and raised (as both Group 1 and 2) the **issues of teachers training, strict curriculum** and **assessment**. It is important to note that when presenting their views they highlighted that the **greatest challenge for connecting math and sciences to the WoW via IBL approaches lies on their role**. In specific, the poster of this group contained the following points:

Opportunities:

- Project Work in Schools, Subject Clubs in Schools, European Projects, Schools Visits to sites
- The subject of Technology (lower secondary school)
- Laboratory work (in Physics), ICT Laboratories, New Technologies
- Teacher training organized by math and science advisors
- Connections with vocational schools

Challenges:

- Time issues – strict/not flexible curriculum
- Too much to teach according to the curriculum
- Lack of a “cooperation culture”
- Subjects with only one teaching hour per week in the curriculum
- Assessment
- Questioning of the traditional role of the teacher
- Connection to the WoW settings
- Teacher training

3.3 Recommendations- Outcomes of the 2nd Session

The main objective of the 2nd session of the workshop was to **negotiate** over the issues that raised in the previously and **formulate recommendations** on how to **take advantage opportunities** and how to **overcome difficulties** with the view **to connect mathematics and sciences with the WoW by IBL**. Three heterogeneous groups were formed (each focused on one of the themes: IBL, WoW, teacher training) which provided us with the following feedback:

Recommendations on IBL

Taking advantage of opportunities

- The teachers' guidelines book should contain exemplars of IBL activities for specific curriculum lessons
- The curriculum should allow at least 2 hours per semester for IBL activities
- Teachers should be motivated to follow training courses on IBL and teaching methods
- Schools should allow and reinforce active cooperation and synergies between teachers of different subjects
- The development of teachers' training courses on IBL should be made by central authorities

Overcoming difficulties/facing challenges

- The curriculum should be more focused (teaching less topics) and more flexible so as to allow IBL approaches
- In the exams, an open-problem should be added to allow assessment of IBL outcomes

Recommendations on WoW

Taking advantage of opportunities

- One of the project works should be on the theme of WoW
- One of the laboratory activities should be connected with the WoW

Overcoming difficulties/facing challenges

- Teachers should be responsible of making a report at the end of each school year with recommendations on the curriculum
- For schools that participate in research projects, they should be given the opportunity to develop a part of the project so as to incorporate connections with the WoW
- Students' assessment should be seen irrespective of exams

Recommendations on teacher training

Taking advantage of opportunities

- Teacher training and professional development should be obligatory each year
- Teacher training should be taken place both by Universities and IEP
- Teachers should be actively support each other (by participating in communities of practice) and be supported by advisors (in group meetings in which good practices are presented and discussed)
- “Certificate of Pedagogical adequacy”

Overcoming difficulties/facing challenges

- Promotion of synergies between schools and Universities/Research centres
- Motivate teachers that follow more traditional teaching methods to participate in teacher training courses
- Central funding for teachers professional development

The recommendations that emerged from the participants’ negotiation over opportunities and challenges could be characterized as **concrete** and **realistic**. Rather than focusing on the macro educational level and on the need of large scale structural changes, participants **emphasized the need to take advantage of opportunities in the existing context** providing **specific actions at small scale** that are believed to make a difference (for example improve teachers ‘guidelines book with concrete examples of IBL and WoW actions, existing project works and laboratory activities focus more on WoW via IBL approaches). Prominent dimensions in their recommendations relate to the issues of tight **curriculum** (proposing a reforms towards **more flexibility**), **assessment** (proposing an obligatory open problem in the final exams) and **teacher training** (proposing central development of CPD courses with the close cooperation among policy, research and practice fields). The need to **create a cooperation culture** both among stakeholders within the same systemic level and across educational levels seemed to be a shared vision and requirement for educational improvement.

3.4 Structuring issues in terms of educational priorities- Outcomes of the 3rd Session

Session 3 aimed at **structuring** the **issues** raised in the previous sessions, **in terms of broader educational priorities: equity, achievement and entrepreneurship**. Discussions took place in the **plenary** with the impetus of the following question:

“Could the connection of science and math to the WoW via IBL approaches be a vehicle towards meeting broader educational priorities, such as equity, achievement and entrepreneurship? How?”

At the beginning, discussions focused on **the theme of entrepreneurship** with a participant raising the issue of whether (and if yes up to what degree) we consider entrepreneurship as an educational priority and whether it connects with innovation.

Different views were communicated in the plenary on the issue: some participants supported that entrepreneurship should not be considered as an educational priority –since it just relates to making profit – while others argued the opposite – since it covers societal needs. Among the opinions expressed was that entrepreneurship should be a priority in education as it allows student feel innovative and inventive. In this case, ***connecting math and science education to the WoW via IBL promotes entrepreneurship***, by the development of students’ competences and skills. Discussions were then directed towards what we mean by IBL approach and under which circumstances IBL leads to development of skills that relate to the promotion of entrepreneurship. There seemed to be consensus that open inquiries are more likely to lead to this outcome rather than structured ones.

Participants then focused on ***the theme of equity***, and the consideration on whether IBL approaches could promote equity. Gender differences in terms of learning were mentioned, with the participants drawing on their personal experiences to support whether or not boys or girls seem to benefit more from IBL. Other participants expressed the view that we should not reproduce stereotypes in terms of gender and that we should focus on equity in terms of some students’ disadvantage background and low achievers. Discussions were then directed in the ***theme of achievement*** and participants expressed their concerns that they have no guidelines on how to deal with students’ disadvantage background and low achievers. Some pointed out that teachers have practically no flexibility due to curriculum requirements and tight schedule to deal with these students; other participants draw on their personal experiences and shared in the plenary that when they tried connections with the WoW some of the low-achievers students were highly motivated and engaged. There seemed to be consensus that in any case making connections to everyday life is highly motivating for the majority of the students and this may contribute to higher students’ achievement.

4. SUMMARY AND CONCLUSIONS

The Greek Policy Workshop took place on the ***15th of May 2015***, at the Department of Mathematics, University of Athens, with the participation of ***25 stakeholders in the working groups*** in the frame of WP2 of the mascil project.

The ***main aim*** of the workshop was to engage policy stakeholders in Greece in a process of reflection and negotiation on issues relating to IBL and WoW in the country and to acquire new perspectives from them on how to make more effective connections between science and math education with the WoW via IBL approaches. The ***specific objectives*** of the workshop were: ***To raise issues, concerns, opportunities and challenges*** in establishing a framework to connect mathematics and sciences with the WoW by IBL methodology; ***to negotiate over the concerns and formulate proposals*** in order to create an appropriate educational framework for connecting mathematics and sciences with the WoW by IBL methodology; ***to structure reflections and proposals*** in the context of wider educational priorities.

For achieving these objectives we followed a ***European Awareness Scenario Workshop (EASW) setting***, which ***allows for interaction between stakeholders***

and **aim for consensus building rather than instructional approach**. A wide definition of “policy makers” was adopted, which includes people from the **macro-educational level** (in high-level positions related to educational policy), the **meso-educational level** (people who mediate policy envisions to practitioners) and the **micro - educational level** (implementers/practitioners of policy envisions). Key issues for the policy workshop derived from the Greek National report (see D2.1) and the Cross-National analysis of policy contexts report (see D2.2) of the mascil project. We focused on three dimensions -and relating important outcomes of the reports-, in accordance to the three objectives of the workshop (raising issues- negotiating-structuring): Dimension 1: Prominent issues relating to thematic orientation (IBL, WoW and teacher training); Dimension 2: Negotiation of education policies among practitioners from the three systemic levels; Dimension 3: Prominent issues relating to broader educational priorities (equity, achievement, entrepreneurship). The core of the workshop was structured in three sessions/phases in accordance to the three main objectives that we wanted to achieve and above dimensions. Participants discussed and provided feedback in homogeneous and heterogeneous working groups and in the plenary.

Key outcomes of participants’ discussions reported in this paper relate to: **opportunities** and **challenges in establishing a framework to connect mathematics and sciences with the WoW by IBL** (feedback from the three homogeneous working groups); **recommendations** on how to **take advantage opportunities** and how to **overcome difficulties** with the view **to connect mathematics and sciences with the WoW by IBL** (feedback from the three heterogeneous working groups); participants views on how the connection of science and math to the WoW via IBL approaches be a vehicle towards meeting **broader educational priorities, such as equity, achievement and entrepreneurship** (feedback from the plenary).

An important outcome of this workshop was that that **the chosen EASW methodology allowed for making comparisons between the dispositions of different stakeholders groups** in terms of opportunities and challenges for establishing a framework to connect mathematics and sciences with the WoW by IBL. Stakeholders from the macro systemic level (policy makers) emphasized the need to view **challenges under the scope of how these can be transformed to opportunities**, rather than difficulties and barriers that cannot be confronted. Participants from the meso-level highlighted **the important role of mediation, connection and cooperation**, while stakeholders from the micro-level (policy implementation) emphasized that the **greatest challenge for connecting math and sciences to the WoW via IBL approaches lies on their role**. The importance of the different stakeholders dispositions towards taking advantage opportunities and dealing with obstacles should be taken into consideration in the development of an action plan on how best to support inquiry based learning approaches in world of work contexts (future work within WP2 of the project).

Furthermore, the formulation of **concrete and realistic recommendations** on how to **take advantage opportunities** and how to **overcome difficulties** -with the view **to connect mathematics and sciences with the WoW by IBL-** was another important outcome of the reported work. Negotiations between participants from

different systemic levels in heterogeneous groups resulted in the formulation of **proposals on specific actions at a small scale** - rather than focusing on the macro educational level and on the need of large scale structural changes. Issues that raised were attempted to be **structures onto broader educational priorities** (promotion of equity, achievement and entrepreneurship), in an effort to map issues on connecting WoW with science and mathematics onto the broader educational policy context.

The Greek Policy Workshop was **successful in terms of meeting its aims** as we managed to engage engage policy stakeholders in Greece in a process of reflection and negotiation on issues relating to IBL and WoW and acquired their concrete recommendations on how to create a framework in the country for connecting science and math education with WoW via IBL. Outcomes of current work will feed **further developments within WP2** relating to the **analysis of the outcomes of the policy workshops in all countries** and **the production of policy recommendations and action plan** on how best to support inquiry based learning approaches in world of work contexts (Deliverable 2.4, due December 2015).

Appendix of the Greek Policy Report

The Agenda & the Participants of the Greek Policy Work

Συνάντηση Εργασίας (Policy Workshop) του έργου mascil

Αθήνα, Παρασκευή 15 -05- 2015

Τμήμα Μαθηματικών, Πανεπιστημιούπολη Ιλίσσια

Αίθουσα Γ31(3^{ος} όροφος)

Ώρα: 10:30 – 16:00

Διοργάνωση: Ομάδα Εκπαιδευτικής Έρευνας και Αξιολόγησης, ΙΤΕ (Ίδρυμα Τεχνολογίας και Έρευνας), σε συνεργασία με την Ερευνητική ομάδα ΕΚΠΑ (Εθνικό και Καποδιστριακό Πανεπιστήμιο Αθηνών)

Η συνάντηση εργασίας απευθύνεται σε υπεύθυνους χάραξης και εφαρμογής εκπαιδευτικών πολιτικών στους τομείς των μαθηματικών και θετικών επιστημών. Θα εστιάζει στις εκπαιδευτικές πολιτικές και στην εφαρμογή τους στις θεματικές της διερευνητικής μεθόδου μάθησης/διδασκαλίας και στη σύνδεση της διδασκαλίας μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας. Κατά τη διάρκεια της συνάντησης θα συζητηθούν αποτελέσματα συγκριτικής ανάλυσης των εκπαιδευτικών πολιτικών και της εφαρμογής τους στις παραπάνω θεματικές, σε 13 Ευρωπαϊκές χώρες που συμμετέχουν στο έργο, την οποία συντόνισε και διεξείγαγε η ομάδα μας. Απώτερος στόχος της συζήτησης είναι να αναδειχθούν οι ευκαιρίες και οι δυσκολίες στη εφαρμογή των πολιτικών και να διατυπωθούν προτάσεις για την αντιμετώπιση των παραγόντων που εμποδίζουν την αποτελεσματική εφαρμογή τους.

Πρόγραμμα

10:30 – 10:45 : Προσανατολισμοί και στόχοι συνάντησης εργασίας - Συγκριτική μελέτη σε επίπεδο χάραξης εκπαιδευτικής πολιτικής και εφαρμογής της σε 13 ευρωπαϊκές χώρες στη σύνδεση μαθηματικών και φυσικών και φυσικών επιστημών με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης, Κατερίνα Κική-Παπαδάκη

10:45 – 11:00: Το έργο mascil: Διερευνητική μάθηση και χώροι εργασίας στη διδασκαλία των μαθηματικών και φυσικών επιστημών, Δέσποινα Πόταρη

11:00 – 11:15 : Διδακτική παρέμβαση πάνω στη διερευνητική μάθηση και στους χώροι εργασίας στη διδασκαλία των μαθηματικών και φυσικών επιστημών, Παναγιώτα Κοταρίνου

11:15 – 11:30 : Διάλειμμα για καφέ

11:30 – 12:30 : 1^η συνεδρία: Ανάδειξη προβληματισμών, ευκαιρίες και προκλήσεις στη δημιουργία πλαισίου για να συνδεθούν τα μαθηματικά και οι φυσικές επιστήμες με τους

χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης (ομογενείς ομάδες εργασίας)

12:30 – 13:30: 2^η συνεδρία: Διαπραγμάτευση πάνω στους προβληματισμούς, διατύπωση προτάσεων για να τη δημιουργία κατάλληλου εκπαιδευτικού πλαισίου για τη σύνδεση μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης (ετερογενείς ομάδες εργασίας)

13:30-14:30: Διάλειμμα για γεύμα

14:30 – 15:30: Δόμηση προβληματισμών και προτάσεων στα πλαίσια ευρύτερων εκπαιδευτικών προτεραιοτήτων (ολομέλεια)

15:30 – 16:00 : Κλείσιμο συνάντησης

Συμμετέχοντες

Όνοματεπώνυμο	Ιδιότητα
Αλέξανδρος Κατέρης	Φυσικός, 2 ^ο πρότυπο πειραματικό Λύκειο Αθηνών
Ανδρέας Κόλλιας	Επίκουρος Καθηγητής Παντείου
Άννα Αναστασοπούλου	Συντονίστρια
Απόστολος Σιδέρης	Μαθηματικός, 3 ^ο ΓΕΛ Αλίμου
Βαγγέλης Σπηλιωτάκης	Μαθηματικός, Διευθυντής Πειραματικού Γυμνασίου Ηρακλείου
Βασίλης Δουγαλής	Καθηγητής Μαθηματικών Πανεπιστημίου Αθηνών, Διευθυντής ΙΥΜ/ΙΤΕ, Προεδρεύων ΙΤΕ
Βασίλης Τσελφές	Καθηγητής ΕΚΠΑ (ΤΕΑΠΗ) – Διδακτική Φυσικών Επιστημών
Γεωργία Πετροπούλου	Υποψήφια διδάκτωρ
Γιάννης Καραδαμογλου	Φυσικός, Πειραματικό Γυμνάσιο Ηρακλείου
Γιάννης Ρουσάκης	Σύμβουλος ΙΕΠ
Γιώργος Μπαράλος	Σχ.Σύμβουλος ΠΕ03
Γιώργος Ψυχάρης	Λέκτορας, Τμήμα Μαθηματικών, Πανεπιστήμιο Αθηνών
Δέσποινα Πόταρη	Αν. Καθηγήτρια, Τμήμα Μαθηματικών, Πανεπιστήμιο Αθηνών
Ελευθερία Τσουρλιδάκη	Φυσικός, σχεδιασμός και εφαρμογή δράσεων στη διερευνητική διδασκαλία και μάθηση, Ελληνογερμανική Αγωγή
Ελισαβετ Καλογερία	Μαθηματικός
Θάνος Καψάλης	Εισηγητής ΙΕΠ – ΠΕ04.04 Βιολόγος
Καλλιόπη Σιώπη	Μαθηματικός, Πρότυπο Πειραματικό Λύκειο Ευαγγελικής Σχολής

Κώστας Αποστολόπουλος	Σχ. Σύμβουλος ΠΕ04.02, Μέλος ΔΣ της Αρχής Διασφάλισης Ποιότητας για την Πρωτοβάθμια και Δευτεροβάθμια Εκπαίδευση
Κώστας Γαβρίλης	Σχ.Σύμβουλος ΠΕ03
Κατερίνα Κική-Παπαδάκη	Υπεύθυνη ομάδας Εκπαιδευτική Έρευνα και Αξιολόγηση, ΙΤΕ
Μαρία Διακόνου	Φυσικός, Προτυπο πειραματικό Λυκειο Ευαγγελικής Σχολής
Ουρανία Καμάμη	Μαθηματικός, 1 ^ο ΕΠΑΛ Ζωφράφου
Παναγιώτα Κοταρίνου	Μαθηματικός, Καλλιτεχνικό γυμνάσιο Γέρακα με Λυκειακές τάξεις
Παρασκευάς Γιαλούρης	Σχ. Σύμβουλος ΠΕ04.02 Χημικός, Μέλος ΔΣ ΙΕΠ
Πόπη Αρδαβάνη	Μαθηματικός
Παύλος Χατζόπουλος	Συνεργαζόμενος Ερευνητής, Ίδρυμα Τεχνολογίας και Έρευνας (ΙΤΕ)
Σπύρος Ορφανάκης	Σύμβουλος ΙΕΠ-ΠΕ03 Μαθηματικός
Φανη Στυλιανίδου	Φυσικός, Ελληνογερμανική Αγωγή
Φωτεινή Χαϊμαλά	Συνεργαζόμενη Ερευνήτρια, ΙΤΕ
Χριστίνα Παπαζήση	Σχ. Σύμβουλος ΠΕ04.05 Μέλος ΔΣ της Αρχής Διασφάλισης Ποιότητας για την Πρωτοβάθμια και Δευτεροβάθμια Εκπαίδευση
Χρήστος Γκοτζαρίδης	Σύμβουλος ΠΕ04
Χρύσσα Τζουγκράκη	Καθηγήτρια ΕΚΠΑ (Τμ. Χημείας) – Διδακτική της Χημείας

Καταγραφή και χρήση αποτελεσμάτων

Η καταγραφή των αποτελεσμάτων των συζητήσεων των ομάδων εργασίας θα γίνει χωρίς ονομαστική αναφορά των απόψεων. Τα αποτελέσματα θα καταγραφούν ξεχωριστά για κάθε ομάδα εργασίας, και θα τονιστούν τόσο τα κοινά σημεία κάθε ομάδας όσο και τα σημεία διαφοροποίησης. Τα αποτελέσματα της συζήτησης θα συγκριθούν με αυτά που θα προκύψουν από παρόμοιες συναντήσεις εργασίας που διεξάγονται στις 12 (επιπλέον της Ελλάδας) χώρες που συμμετέχουν στο έργο mascil. Απώτερος στόχος της συγκριτικής μελέτης είναι ο σχεδιασμός ενός πλάνου δράσης για την πιο αποτελεσματική εμπλοκή των υπεύθυνων χάραξης εκπαιδευτικής πολιτικής στη σύνδεση των μαθηματικών και των φυσικών επιστημών με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης. Τόσο η έκθεση για την Ελληνική συνάντηση εργασίας, όσο και η συγκριτική μελέτη θα αναρτηθούν με την ολοκλήρωσή τους και θα είναι διαθέσιμες στο ευρύ κοινό μέσω της ιστοσελίδας του έργου (<http://www.mascil-project.eu/>).

Κατερίνα Κική-Παπαδάκη
Υπεύθυνη Ομάδας Εκπαιδευτικής Έρευνας και Αξιολόγησης
Ίδρυμα Τεχνολογίας και Έρευνας

Επικοινωνία

Φωτεινή Χαϊμαλά
2810-391828, 6937778238
haimala@iacm.forth.gr

Briefing paper shared with the participants before the workshops

Προσανατολισμός & Στόχοι Συνάντησης Εργασίας του έργου mascil

Η προβληματική & το υπόβαθρο

Τα τελευταία χρόνια, στην ευρωπαϊκή πολιτική ατζέντα έχει τεθεί ως προτεραιότητα η **βελτίωση της ποιότητας και της αποτελεσματικότητας των συστημάτων εκπαίδευσης και κατάρτισης**, υπό το πρίσμα αυτά να μπορούν να προσφέρουν κατάλληλες δεξιότητες για την απασχόληση, την ενεργό συμμετοχή των πολιτών στα κοινά και την ενίσχυση της καινοτομίας (Education and Training 2020). Μεταξύ άλλων προκλήσεων που πρέπει να αντιμετωπιστούν για την επίτευξη των παραπάνω στρατηγικών προτεραιοτήτων είναι η **εξασφάλιση ίσων ευκαιριών** στην εκπαίδευση και κατάρτιση, η **βελτίωση των μαθησιακών αποτελεσμάτων** και η **προώθηση της επιχειρηματικότητας** (EC Communication, 2012).

Με στόχο την αντιμετώπιση των παραπάνω προκλήσεων, ακολουθούμενες και σχεδιαζόμενες εκπαιδευτικές πολιτικές σε πολλές Ευρωπαϊκές χώρες εστιάζουν όλο και περισσότερο στην **προώθηση της Διερευνητικής Μεθόδου Διδασκαλίας και Μάθησης (ΔΜ Δ&Μ)** – ιδιαίτερα στον τομέα των Μαθηματικών και των Φυσικών Επιστημών – τόσο ως μεθοδολογία για απόκτηση από τους μαθητές βασικών και εγκάρσιων δεξιοτήτων, όσο και ως μέσου για να καταστούν επαγγέλματα σχετικά με τις θετικές επιστήμες ελκυστικά στους νέους (Rocard, 2007; Lord et al., 2005). Παράλληλα, σε επίπεδο διαβουλεύσης εκπαιδευτικών πολιτικών τονίζεται όλο και περισσότερο η ανάγκη να **δημιουργηθούν γέφυρες ανάμεσα στην τυπική εκπαίδευση και στον κόσμο της εργασίας**, μέσα από διδακτικές προσεγγίσεις που να αναπτύσσουν χρήσιμες ικανότητες στους μαθητές για την επαγγελματική τους σταδιοδρομία (Hoyeles et al., 2010). Επιπλέον, η **διασφάλιση υψηλής ποιότητας διδασκαλίας μέσω κατάλληλης εκπαίδευσης των διδασκόντων** αποτελεί κεντρικό σημείο των εκπαιδευτικών πολιτικών σε ευρωπαϊκό επίπεδο, ως βασική προϋπόθεση για την αποτελεσματική εφαρμογή κατευθυντήριων πολιτικών στην εκπαιδευτική πράξη (Education and Training 2020).

Υπό το πρίσμα των παραπάνω εξελίξεων, **στα πλαίσια του Ευρωπαϊκού έργου mascil** (Ανακαλύπτοντας τα Μαθηματικά και τις Φυσικές Επιστήμες στην καθημερινή ζωή και στους χώρους Εργασίας) η Ομάδα Εκπαιδευτικής Έρευνας και Αξιολόγησης του ΙΤΕ (Ίδρυμα Τεχνολογίας και Έρευνας) οργάνωσε, συντόνισε και διεξείγαγε μια **συγκριτική μελέτη και ανάλυση για τις ακολουθούμενες και σχεδιαζόμενες εκπαιδευτικές πολιτικές σε Ευρωπαϊκό επίπεδο** στον τομέα των Μαθηματικών και των Φυσικών Επιστημών. Η συγκριτική μελέτη και ανάλυση καλύπτει **13 Ευρωπαϊκές χώρες** (Γερμανία, Ελλάδα, Ολλανδία, Ηνωμένο Βασίλειο, Ισπανία, Κύπρος, Νορβηγία, Τσεχία, Τουρκία, Λιθουανία, Αυστρία και Βουλγαρία). Λαμβάνει ως **έτος αναφοράς το 2013**, ενώ οι αλλαγές και οι μεταρρυθμίσεις που προβλέπονται για τα επόμενα έτη έχουν ληφθεί υπόψη.

Η μελέτη εστίασε **σε 3 θεματικές**: Διερευνητική Μέθοδος Διδασκαλίας και Μάθησης (ΔΜ Δ&Μ), Σύνδεση διδασκαλίας Μαθηματικών και Φυσικών Επιστημών με τον κόσμο της εργασίας (ΚΕ), Εκπαίδευση Εκπαιδευτικών στη ΔΜ Δ&Μ και ΚΕ. Με τη βοήθεια ενός αναλυτικού πλαισίου, οι παραπάνω θεματικές μελετήθηκαν **σε 3 επίπεδα συστηματικής ανάλυσης**: α.το **μάκρο-επίπεδο**

Προτεραιότητες & προκλήσεις στην εκπαίδευση Μαθηματικών και Φυσικών Επιστημών

Η συγκριτική μελέτη για τις εκπαιδευτικές πολιτικές του έργου mascil

(σχετικό με χάραξη εκπαιδευτικών πολιτικών), β. μέσο-επίπεδο (σχετικά με τους μηχανισμούς με τους οποίους υπεύθυνοι φορέων μεσολαβούν ανάμεσα στη χάραξη εκπαιδευτικών πολιτικών και στην εφαρμογή τους σε χώρους τυπικής εκπαίδευσης) και γ. μικρο-επίπεδο (αναφορικά με την εφαρμογή των εκπαιδευτικών πολιτικών στους χώρους διδασκαλίας και μάθησης). Το πλαίσιο μελέτης και ανάλυσης ενσωμάτωσε **3 ευρύτερες εκπαιδευτικές στρατηγικές προτεραιότητες**: εξασφάλιση ίσων ευκαιριών στην εκπαίδευση και κατάρτιση, βελτίωση των μαθησιακών αποτελεσμάτων και προώθηση της επιχειρηματικότητας.

Η συγκριτική ανάλυση υλοποιήθηκε πολυδιάστατα – υπό το πρίσμα μακρο-, μέσο- και μικρο-επίπεδου χάραξης και υλοποίησης πολιτικής, σε σχέση με τις 3 θεματικές εστίασης και υπό το πρίσμα των ευρύτερων στρατηγικών εκπαιδευτικών προτεραιοτήτων. **Από την ανάλυση αναδύθηκαν κύρια ζητήματα** που αφορούν τις ακολουθούμενες και σχεδιαζόμενες εκπαιδευτικές πολιτικές στις 3 εστιαζόμενες θεματικές, τον τρόπο και το βαθμό που αυτές εφαρμόζονται (ή όχι) στις χώρες αναφοράς, τις ευκαιρίες αλλά και τις δυσκολίες για την υλοποίηση. Επίσης, **διατυπώθηκαν προτάσεις** για την αποτελεσματική αντιμετώπιση των προκλήσεων που αναγνωρίστηκαν σε σχέση με την υλοποίηση των εκπαιδευτικών πολιτικών⁴.

Θέματα που αναδύθηκαν από τη συγκριτική μελέτη: το εφαλτήριο για τη συνάντηση εργασίας

Από τη συγκριτική μελέτη που υλοποιήθηκε προέκυψαν θέματα τα οποία θα χρησιμοποιηθούν ως το εφαλτήριο για τη συνάντηση εργασίας στην οποία έχετε προσκληθεί να λάβετε μέρος. Πιο συγκεκριμένα η μελέτη ενέδειξε ότι:

- Σε πολλές ευρωπαϊκές χώρες (της Ελλάδας συμπεριλαμβανομένης) **η διερευνητική μέθοδος διδασκαλίας και μάθησης παραμένει σε επίπεδο ρητορικής** στη χάραξη εκπαιδευτικών πολιτικών, χωρίς να βρίσκει ευρεία εφαρμογή στην εκπαιδευτική πράξη. Κύρια ζητήματα σε επίπεδο θεματικής
- Σε κάποιες ευρωπαϊκές χώρες (της Ελλάδας συμπεριλαμβανομένης) η **σύνδεση των μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας** αναδεικνύεται μέσω δραστηριοτήτων **εκτός του επίσημου προγράμματος σπουδών**, περισσότερο στην επαγγελματική και λιγότερο στη γενική εκπαίδευση.
- Σε πολλές ευρωπαϊκές χώρες (της Ελλάδας συμπεριλαμβανομένης) **δεν υπάρχει συνάφεια ανάμεσα σε στόχους** προγραμμάτων σπουδών (σε επίπεδο αποτελεσμάτων στους μαθητές) και σε στόχους προγραμμάτων εκπαίδευσης εκπαιδευτικών.
- Στην πλειονότητα των χωρών οι εκπαιδευτικές αλλαγές μοιάζουν να παραμένουν σε επίπεδο ρητορικής, χωρίς ευρεία εφαρμογή σε επίπεδο σχολείου και τάξης. Γίνεται εμφανής η **ανάγκη να προαχθεί η συνέργεια και να χτιστούν γέφυρες μεταξύ επιστημονικής έρευνας, διαμόρφωσης εκπαιδευτικής πολιτικής και εφαρμογής της** για αντιμετωπιστούν οι προκλήσεις και να επιτευχθεί η αποτελεσματική εφαρμογή των προτεινόμενων αλλαγών. Κύριο ζήτημα σε επίπεδο διαπραγμάτευσης εκπαιδευτικών πολιτικών
- Η εκπαίδευση σε μεθόδους διερευνητικής μάθησης στις περισσότερες χώρες **δεν λαμβάνει υπόψη της διαφορές σε σχέση με το φύλο** Κύρια ζητήματα σε επίπεδο ευρύτερων εκπαιδευτικών στόχων

⁴ Τα αποτελέσματα της συγκριτικής μελέτης έχουν δημοσιευτεί στα αγγλικά στην ιστοσελίδα [mascil project.eu/images/pdf/Crossnational%20report%20and%20policy%20paper.pdf](http://mascil.project.eu/images/pdf/Crossnational%20report%20and%20policy%20paper.pdf).

(αναφορικά με ενδιαφέροντα, στυλ μάθησης, κίνητρα) παρά το ότι υπάρχουν ενδείξεις από έρευνες ότι η διερευνητική μέθοδος μάθησης μπορεί να βοηθήσει σε μείωση στερεοτύπων σε σχέση με το φύλο και τη μάθηση.

- Παρά το ότι η **αντιμετώπιση χαμηλών επιδόσεων στα μαθηματικά και στις θετικές επιστήμες** είναι προτεραιότητα στην εκπαιδευτική πολιτική στην πλειονότητα των χωρών, μόνο σε λίγες χώρες έχουν διατυπωθεί συγκεκριμένα μέτρα για το πώς κάτι τέτοιο μπορεί να επιτευχθεί.
- Στις περισσότερες χώρες **δεν δίνονται κατεθυντήριες οδηγίες** σχετικά με το πως μπορούν να ενταχθούν μέσα στη σχολική τάξη δραστηριότητες που να συνδέονται με την **επιχειρηματικότητα**.

Με εφελτήριο τα παραπάνω αποτελέσματα η συνάντηση εργασίας που θα πραγματοποιηθεί έχει ως ειδικούς στόχους:

Στόχοι της συνάντησης εργασίας

- **Ανάδειξη προβληματισμών**, ευκαιριών και προκλήσεων στη δημιουργία πλαισίου για να συνδεθούν τα μαθηματικά και οι φυσικές επιστήμες με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης.
- **Διαπραγμάτευση πάνω στους προβληματισμούς**, διατύπωση προτάσεων για να τη δημιουργία κατάλληλου εκπαιδευτικού πλαισίου για τη σύνδεση μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης.
- **Δόμηση προβληματισμών και προτάσεων** στα πλαίσια ευρύτερων εκπαιδευτικών προτεραιοτήτων.

Ευρύτερος στόχος της συνάντησης είναι να συμβάλει στην προαγωγή της συνέργειας μεταξύ επιστημονικής έρευνας, διαμόρφωσης εκπαιδευτικής πολιτικής και εφαρμογής της.

Μεθοδολογία της συνάντησης εργασίας

Η συνάντηση εργασίας θα ακολουθήσει μια παραλλαγή της μεθοδολογίας European Awareness Scenario Workshop (**EASW**), η οποία επιτρέπει την αλληλεπίδραση ανάμεσα σε υπεύθυνους από διαφορετικούς τομείς. Οι συμμετέχοντες αλληλεπιδρούν σε ομάδες ομογενείς και ετερογενείς καθώς και στην ολομέλεια, αναπτύσσουν σενάρια πάνω στη θεματική (ευκαιρίες και προκλήσεις), και προτείνουν στρατηγικές και βήματα ώστε να χρησιμοποιηθούν οι ευκαιρίες και να αρθούν οι προσκλήσεις. Ειδικότερα, στη συνάντηση εργασίας θα πραγματοποιηθούν 3 συνεδρίες:

1^η συνεδρία: Ανάδειξη προβληματισμών – Ομογενείς ομάδες εργασίας

Με εφελτήριο αποτελέσματα της συγκριτικής μελέτης οι συμμετάσχοντες θα συζητήσουν σε ομογενείς ομάδες (Ομάδα 1: υπεύθυνοι χάραξης πολιτικής, Ομάδα 2: υπεύθυνοι διαμεσολάβησης πολιτικής, Ομάδα 3: υπεύθυνοι εφαρμογής πολιτικής) πάνω στις ευκαιρίες και προκλήσεις στη δημιουργία πλαισίου για να συνδεθούν τα μαθηματικά και οι φυσικές επιστήμες με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης. Τα αποτελέσματα της συζήτησης κάθε ομάδας θα σημειωθούν σε πόστερ και θα παρουσιαστούν στην ολομέλεια.

2^η συνεδρία: Διαπραγμάτευση πάνω στους προβληματισμούς – Ετερογενείς ομάδες

Οι συμμετάσχοντες θα χωριστούν σε 3 ανομοιογενείς ομάδες: ομάδα Α (διερευνητική μέθοδος μάθησης), ομάδα Β (σύνδεση μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας), Ομάδα Γ (εκπαίδευση εκπαιδευτικών σε σύνδεση μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας μέσω διερευνητικής μεθόδου). Κάθε ομάδα θα εστιάσει στις ευκαιρίες και στις προκλήσεις όπως διατυπώθηκαν στην προηγούμενη ενότητα που να αφορούν στη θεματική τους. Θα συζητήσει με στόχο να προτείνει παρεμβάσεις μέσω των οποίων οι ευκαιρίες μπορούν να χρησιμοποιηθούν και οι προκλήσεις να μπορούσαν να αντιμετωπιστούν. Τα αποτελέσματα της συζήτησης κάθε ομάδας θα σημειωθούν σε πόστερ και θα παρουσιαστούν στην ολομέλεια.

3^η συνεδρία: Δόμηση προβληματισμών και προτάσεων – Ολομέλεια

Ανοιχτή συζήτηση στην ολομέλεια με στόχο τη δόμηση προβληματισμών και προτάσεων στα πλαίσια ευρύτερων εκπαιδευτικών προτεραιοτήτων: εξασφάλιση ίσων ευκαιριών, βελτίωση μαθησιακών αποτελεσμάτων, προώθηση επιχειρηματικότητας. Θα συζητηθεί κατά πόσο και με ποιούς τρόπους θα μπορούσε η σύνδεση μαθηματικών και φυσικών επιστημών με τους χώρους εργασίας μέσω της διερευνητικής μεθόδου μάθησης να βοηθήσει προς την επίτευξη ευρύτερων εκπαιδευτικών στρατηγικών προτεραιοτήτων. Κύρια σημεία της συζήτησης θα σημειωθούν σε πόστερ.

Καταγραφή και χρήση αποτελεσμάτων

Η καταγραφή των αποτελεσμάτων των συζητήσεων των ομάδων εργασίας θα γίνει χωρίς ονομαστική αναφορά των απόψεων. Τα αποτελέσματα θα καταγραφούν ξεχωριστά για κάθε ομάδα εργασίας, και θα τονιστούν τόσο τα κοινά σημεία κάθε ομάδας όσο και τα σημεία διαφοροποίησης. Τα αποτελέσματα της συζήτησης θα συγκριθούν με αυτά που θα προκύψουν από παρόμοιες συναντήσεις εργασίας που διεξάγονται στις 12 (επιπλέον της Ελλάδας) χώρες που συμμετέχουν στο έργο mascil. Απώτερος στόχος της συγκριτικής μελέτης είναι ο σχεδιασμός ενός πλάνου δράσης για την πιο αποτελεσματική εμπλοκή των υπεύθυνων χάραξης εκπαιδευτικής πολιτικής στη σύνδεση των μαθηματικών και των φυσικών επιστημών με τους χώρους εργασίας, μέσω της διερευνητικής μεθόδου διδασκαλίας και μάθησης. Τόσο η έκθεση για την Ελληνική συνάντηση εργασίας, όσο και η συγκριτική μελέτη θα αναρτηθούν με την ολοκλήρωσή τους και θα είναι διαθέσιμες στο ευρύ κοινό μέσω της ιστοσελίδας του έργου (<http://www.mascil-project.eu/>).

Υπεύθυνη Διοργάνωσης

Κατερίνα Κική-Παπαδάκη

Υπεύθυνη Ομάδας Εκπαιδευτικής Έρευνας και Αξιολόγησης

Ίδρυμα Τεχνολογίας και Έρευνας

Επικοινωνία

Φωτεινή Χαϊμαλά

2810-391828, 6937778238

haimala@iacm.forth.gr

Photos





1.3 National Policy Paper : the Netherlands

Vincent Jonker & Michiel Doorman

1. INTRODUCTION

Science and mathematics examination programmes for secondary schools in the Netherlands have been reformed, the resulting context-based programmes starting at the national level in 2013 and 2015. One of the aims of renewing the single disciplines was to make them more coherent. All programmes define common competences related to research, design and communication. These reforms seem to offer opportunities for mascil to emphasise Inquiry-based Learning (IBL) and connections to workplace contexts in science and mathematics education. However, the Ministry of Education also decided to reduce government interference with pedagogical and didactical aspects of education. The Ministry now mainly focuses on the core objectives of education with an emphasis on mathematical (or even arithmetical) skills for secondary education. In addition, the past decades responsibility for professional development of teachers is increasingly transferred to school authorities. These reforms have impact on the current educational practices in relation to policy initiatives from the national level to school levels.

The work within the mascil work package 2 in the Netherlands aims to better understand the dynamics of policy initiatives with respect to implementing IBL and World-of-Work contexts (WoW) in daily teaching practices. Moreover, this paper describes how the organization of a policy workshop helped to create a common understanding and to find directions for more coherence in the Dutch educational system with respect to the aims of mascil.

2. APPROACH AND METHODOLOGY

2.1 Introduction

The context for bringing together policy makers is shaped by the meetings and discussions with the mascil National Advisory Board. This board involves representatives of various educational levels in the Netherlands, teacher training institutions, industry and from institutions that work closely together with the Dutch Ministry of Education in the area of science, mathematics and technology education.

Issues that were raised in the meeting with NAB in Netherlands concern the following:

- a) It is difficult to make a strong connection between general secondary education and vocational education. Although general schools can learn from the expertise of 'the World of Work' from vocational education, there is no tradition in meeting each other.
- b) It is important to make immediate connections between the pre-service training of teachers and what mascil is going to do in in-service teacher training.

The European dimension of mascil can provide a vital stimulus and inspiration for development at all levels, including for teachers involved in the project, who can take inspiration from working as part of a European network. The project can help to

strengthen a network of teachers, teacher trainers and researchers by building upon the existing networks, by guiding the underlying ideas, pedagogy and by offering empirically tested activities for students and for professional development.

The Dutch school system is geared towards streaming students from age 12 towards different levels of vocational education and further study. Recent decreases in the number of students choosing for technical studies has lead the ministry of education to make a plan for improving connections between education, the world of work and regional collaboration between schools and companies, called Techniekpact. This pact contains 22 agreements between that strengthens the connection between education in the technics sector and the shortfall of technical personnel. A mascil representative from the Platform for Science and Technology (PBT/Jet-Net) is involved in the coordination of the Techniekpact. This initiative and our connections within the NAB offer opportunities for mascil help supporting the related aims.

2.2 Rationale for selection of policy makers

As a result of the context for the policy workshop the main aims for this workshop became:

1. Better understanding of aims, opportunities and obstacles for implementing IBL in connection with WoW contexts in science and mathematics education
2. Better connections between mascil aims and national initiatives and curriculum innovations
3. Increasing coherence in supporting the implementation of IBL and connections to WoW on all levels (primary, secondary and vocational education)

To reach these aims we planned to invite representatives from PBT (Platform Betatechniek: commissioned by the Dutch government to support innovation and to achieve a structural increase of students in science and technology), Jet-Net, SLO (national institute for curriculum development and innovation), national associations for science and mathematics teachers, national centers for teacher training, teacher trainer associations (ELWIER/ECENT), regional networks for STEM (W&T for primary education and Beta steunpunten for secondary education), and representatives from closely related European projects (e.g InGenious, PARRISE, MASS).

2.3 Rationale for selection of specific issues for discussion

In relation to the intended aims of the policy workshop we wanted to achieve a better understanding of opportunities and obstacles for the national implementation of IBL in science and technology in relation to national and regional policies. The participants of the workshop are expected to contribute to issues like:

- How can the opportunities be exploited and the obstacles be overcome?
- What recommendations can we give to educational policy on a national level?
- How can we align the national and regional initiatives for science and technology in primary education (W&T) and in secondary education (Beta steunpunten)?

- How can PBT further support project-related initiatives such that they not only support change and innovation during the lifetime of these projects?
- How can the mascil endeavour be supported?

These issues are specific for the Dutch context and answers to these questions will help to move forward with all stakeholders in the implementation of IBL and the use of WoW contexts.

We discussed these issues within our NAB. Harrie Eijkelhof suggested to target specific people to invite. Vincent Jonker would include someone from the Ministry of Education. Sebastian Smit suggests inviting one or more guests from abroad. Andre van Aperen suggests presenting good practices with professional contexts. Rutger van der Sande would use some of the ambitions from the Techniekpact as a focus for the meeting. There are several options for combining this meeting: for instance, a meeting of the Platform Beta Techniek in Rotterdam. On March 12 there is a suitable event at the TU, at the end of March there are the NVON-day and Onderwijs 2032.

As a conclusion we planned the following: a meeting in March during which three projects/initiatives will present their aims, strategy and results with respect to the implementation of IBL and workplace-related innovations. The date was fixed in line with the options of persons representing these projects (mascil, Jetnet, Parrise or Primas or MASS). Next, we invited the above mentioned people related to educational policy.

The tentative schedule of the day was:

- Three 20' presentations
- Plenary discussion of differences & commonalities and what we can learn from these projects
- Forum discussion on how policy can better support, align these initiatives and ensure their sustainability

3. THE DUTCH NPW

The Dutch policy workshop took place at March 17, 2015 at Utrecht University. We had 24 participants (see appendix) from all intended target groups.



3.1 Setting and Context of NPW

The program of the National Policy Workshop consisted of three presentations and a discussion. The presentations were:

1. Gerard Dummer: Lego league (IBL in primary education)
2. Andre van Aperen: JetNet/SHELL Masterclasses (WoW in upper secondary education)
3. Erica Aalsma: The Technology factory (IBL and WoW in vocational education)

These three presentations created a rich pallet of affordances and constraints with respect to implementing mascil related aims in the Dutch educational system. In addition, each of the implementation issues could be discussed within the specific educational level, but also in relation to the other experiences. Furthermore, the other participants got the opportunity to add their experiences or ideas to the discussion.

3.2 Themes and issues discussed

The purpose of our policy meeting was to connect IBL and WoW to national initiatives and curriculum renewal, to increase coherence in supporting the implementation of IBL and connections to WoW, and to create common understanding of IBL/WoW in science and mathematics education. The schedule of the meeting is to start with three 20' presentations which are illustrative for initiatives in different educational areas (respectively primary, secondary and vocational). This is followed by a plenary discussion of differences & commonalities and what we can learn from these projects and how policy can better support, align these initiatives and ensure their sustainability. Many voices from different backgrounds contributed to the discussion.

The overarching questions for each of the presentations were:

- What is the position of IBL in the current science curricula?

Feedback from participants:

IBL is mostly addressed by extra-curricular projects (e.g. Maker Movement). This leads to activities that ask for investments of more than one lesson and for a different concept of teaching. The advantage of out-of-school projects is that time is not a major issue and it is easier to involve parents. But we should not support a dichotomy between in-school and out-of-school learning. We need to stimulate the integration of IBL in the teaching books (the aims are already formulated in the national curricula). In a follow-up event we need to involve educational publishers in a workshop like this.

- How can connections between primary, secondary and vocational education be enforced with respect to IBL and the use of WoW contexts?

Feedback from participants:

We can learn a lot from what is happening at primary schools. Children learn to collaborate and work on projects together. In secondary schools many of these initial developments are not continued. We need to clarify this continuous learning lines with respect to IBL and the use of WoW contexts. Especially, more explicit experiences about the use of discipline knowledge and skills in the workplace is needed in lines from secondary to vocational education.

- How can a European project like mascil, with a limited lifetime, enforce or support (national) policy initiatives?

Feedback from participants:

We have national curricular documents and descriptions that support the implementation of IBL and WoW. We could support the inspection to create guidelines that they can use when they visit and evaluate schools. The mascil project could try to support the establishment of a common vocabulary and underpinning of IBL (connect to what is happening at the VU – Bert van Oers). Try to prevent that you want teachers to use some isolated (mascil) tasks next to their books. Make clear that the project is about developing another attitude and addressing important teaching goals. Make clear how these goals are connected to the national curricula and to innovations like the concept-context approaches in science. Also connect to teacher-development-teams (DOT's), the new vehicle for professional development of teachers.

3.3 Recommendations

All national IBL and WoW supporting initiatives seem to need long implementation processes and are in competition with short term responsibilities related to basic and national assessments. This creates implementation difficulties on the curriculum level that is not easy to solve. Teachers still have the feeling that their textbook is their main guide for daily practice. All policy makers acknowledge the importance of IBL and WoW connections, support activities in these directions, but don't have answers for sustainable implementation.

The mascil project will contact the VU (university in Amsterdam) to create a common vocabulary with respect to IBL and its importance for science education. With the mascil tasks the project will try report on experiences in primary and secondary schools to elicit longer learning lines and to prevent that teachers have the impression that mascil tasks are isolated activities. The mascil project is recommended to make clear that IBL needs the development of another teaching attitude and addressing important goals in science that are connected to the national curricula and to innovations like the concept-context approaches in science. The project is also recommended to look for continuation of professional development initiatives by connecting to teacher-development-teams (DOT's).

4. CONCLUSION AND DISCUSSION

The policy workshop appeared to be successful with respect to creating awareness among stakeholders about the variety of initiatives related to IBL and WoW contexts in primary, secondary and vocational education. Aims, opportunities and obstacles for implementing IBL in connection with WoW contexts in science and mathematics education were discussed. The need for a common vocabulary was expressed. The workshop contributed to better connections between mascil aims and current national and regional initiatives and curriculum innovations and provided recommendations that have the potential to be addressed during the lifetime of mascil. We were able to address the importance of coherence in supporting the implementation of IBL and connections to WoW on all levels (primary, secondary and vocational education). The discussion of affordances and limitations within each of the educational levels appeared to be helpful to better understand what is (im) possible with respect to the

implementation of mascil related aims in the Dutch context. Policy makers on all levels, from national operating institutions to regional institutions and schools, acknowledged the importance of attention for IBL and WoW contexts in science and mathematics education, but don't see short term options for a sustainable implementation.

The policy workshop also contributed to the 'visibility' of mascil and we will try to enrich our NAB with some of the NPW participants. We will continue our discussion within the mascil NAB. Furthermore, the NPW resulted in bilateral meetings with some specific stakeholders about further initiatives in the near future (e.g. PBT and establishing sustainable networks for PD). Finally, it appeared to be difficult to connect to policy initiatives from the Ministry of Education through some of the national institutions that participated in the NPW. In the near future we will try to contact people from the ministry directly to further discuss the potential of Dutch EU projects for a sustainable improvement of science and mathematics education in the Netherlands.

Appendix – The participants of the Policy meeting

Herman Schalk - SLO

Marc van Zanten - SLO

Marcel Voorhoeve – Board of schools in Utrecht

Marja van Graft - SLO

Frans van Galen - UU

Tim van Wessel – O&T/UU

Dirk-Jan Boerwinkel - UU

Maarten Reichwein – Wetenschapsknooppunt Utrecht

Fokke Munk - iPabo

Andre van Aperen – Shell / JetNet

Erica Aalsma - The Technology factory

Gerard Dummer – Pabo Amersfoort

Hanno van Keulen – Hogeschool Windesheim

Dannie Wammes – Hogeschool van Arnhem/Nijmegen

Maria da Silva - UU

Rupert Genseberger - ZZP

Nico Rutten - UU

Andrea Bruggen-van der Lugt – Secondary school teacher/UU

Sebastiaan Smit - Platform Betatechniek

Dolly van Eerde - UU

Vincent Jonker – UU/Mascil

Monica Wijers – UU/Mascil

Michiel Doorman – UU/Mascil

Nathalie Kuijpers – UU/Mascil

1.4 Statement and Plan of Action: UK

Geoffrey Wake

The political scene regarding mathematics education and education more widely has seen a very large number of changes in the past 18 months or so. Specifically with relation to mathematics there has been a major development in reorganising the structures that support professional development for in-service teachers of mathematics: the launch of a national network of maths hubs. These are led by 34 schools across the country and in general may be considered as taking over many of the roles formerly in the remit of Local Authorities which, in most areas of the country, now have very little to do with teacher professional development.

“The Maths Hubs programme for the first time brings together all mathematics education professionals in a national network of hubs, each locally led by an outstanding school or college, and in partnership with neighbouring schools, colleges, universities, CPD providers, maths experts and employers. This is a new way of harnessing all maths teaching expertise within an area, to spread excellent practice even more widely, for the benefit of all pupils and students.

The national dimension of the programme is made possible by the hubs collaborating as a national group, pooling experience, expertise and ideas as a network, and meeting once a term at the National Maths Hubs Forum. This is a new way of fast-tracking current, school-based practice and research to an environment where national policy objectives can be explored and new ideas formulated.”
<http://www.mathshubs.org.uk/about-maths-hubs/>

This has provided both challenges and opportunities for the Nottingham team in working with the newly emergent systems of support for professional development of mathematics teachers. The main challenge has been one of timing – the development came at a most inopportune time for the project in the UK. Put very simply, because of the major change that has been brought about there has been a period when it has not been possible to engage with these new “policy-makers” as they went through a process of selecting these new ‘local’ leaders. On the other hand the changes have provided a major opportunity for the team: we have worked hard and are now a national partner of the hubs with mascil potentially contributing to developments across a number of the hubs in their next phase of funding (July 2015 – June 2016). This has been achieved by the team working closely with the National Centre for Excellence in Teaching Mathematics (NCETM).

Further to this in the period of the proposed National Policy Workshop the UK faced a general election with future education policy being determined by the winning political group. In this period as well as there being uncertainty about changes to the curriculum civil servants who support government in their work are not allowed to engage in policy development as such work may be wasteful of resource as there may be a change in direction. The election (7th May 2015) resulted in little change in government but with some changed priorities. The team will work with policy-makers and key stake-holders now that intentions are clear and plan to hold their policy workshop at the start of the autumn term 2015 (that is September/October). Preparations for this are underway.

1.5 National Policy Paper : Spain

Fco. Javier García García

1. INTRODUCTION

1.1 Overview of work package 2

According to mascil's description of work (DoW, from now on), a main objective of Mascil is to initiate a dialog with national and EU policy-makers in order to affect the teaching and learning of mathematics and science, promoting an orientation towards IBL and connections between these school subjects and the world of work.

To do so, an analysis of educational systems and policy contexts has already been completed (deliverable D.2.1). This analysis has identified opportunities and challenges for a wider uptake of IBL, and an initial set of recommendations has been drawn.

During the analysis within each country, consortium members have had the opportunity to identify key national challenges that, in turn, might orientate their efforts in the implementation of Mascil within their countries. The National Policy Workshops are a part of the overall Mascil strategy, oriented towards increasing the impact of Mascil. Depending on the context and needs in each country, key policy makers and main policies have been identified, and workshops have taken place. The aim of these workshops has been to foster cooperation and synergies by producing strategies to support the widespread uptake of inquiry-based science teaching.

1.2 Summary of national policy paper

In Spain, national and regional policies are supportive for including inquiry-based teaching in school. Since the 2006 reform, which reformulated students' achievement in terms of competencies, clear directions towards IBL can be found in the curriculum as well as in other policy papers.

However, the integration of IBL in daily classroom practices is still insufficient. There is a gap between policy intentions, on the one hand, and classroom level, on the other hand. Our policy workshop focused on this gap, trying to find strategies to reduce it.

Key policy makers from the Andalusian Regional Ministry of Education were invited to reflect on the actions that could be undertaken to reduce this gap. Already existing and successful actions led by the Regional Ministry to spread innovations and policies were identified, and their possible orientation towards science and mathematics teaching was discussed.

The workshop was quite successful. Important synergies were found between Regional and National policies, on the one hand, and Mascil's aims, on the other hand. Besides, specific actions for the future were discussed. Among them, collaborating in the design of an specific plan for those schools that want to orientate their mathematics and science teaching practices towards IBL, which includes in-

school professional development courses and continuing support by a group of expert lead by the Mascil consortium members.

2. APPROACH AND METHODOLOGY

2.1 Rationale for selection of policy makers

In Spain, Mascil national team is placed within the region of Andalusia. Since educational competencies have been transferred to each Autonomous Region, and considering that Andalusia is one of the biggest regions in Europe, we decided that our work should be focused mainly there. This does not mean that we are not working nationally as well, for instance, through a fruitful cooperation with the National Institute of Educational Technologies and Teacher Training, depending on the National Ministry of Education. Thus, the National Policy Workshop was restricted to Policy makers within the Regional Ministry of Andalusia.

Second, we had already identified potential actions that could be interesting in terms of Mascil aims. Specifically, there is a set of actions promoted by the Regional Ministry of Education called “Educational Plans and Programs” (<http://www.juntadeandalucia.es/educacion/webportal/web/planes-y-programas>, website in Spanish) that we found quite powerful in terms of spreading IBL in schools. Besides, these plans and programmes include teacher professional development actions, which are in the core of Mascil, as well as an essential dimension to promote a wider uptake of IBL.

Therefore, three policy makers were invited to the workshop, representing key areas within the Regional Ministry of Education:

- Mrs. Luisa López Gómez, Head of Sector, Teacher Professional Development.
- Mr. Manuel Martín González, Head of Sector, Educational Plans and Programs.
- Mr. Rafael García Rivas, Head of Sector, Educational Innovation.

Although the group of policy makers can be considered to be small, it was very coherent with our aims. We did not want a big group in which discussions could have gone in different directions, in a more superficial level. On the contrary, we wanted a small group focused on the kind of discussion we wanted to promote, and which includes policy makers within a level in the Regional Ministry in which decisions are taken.

2.2 Rationale for selection of specific issues for discussion

In Andalusia, there is a wide network of professional development centres (the so called Teachers Centre, 32 in total), which depends directly from the Regional Ministry of Education. Every school is connected to one of these centres, which is responsible of detecting teachers’ needs and providing professional development according to them. Besides, Teachers Centres also spread policy priorities among teachers through the promotion of PD courses, conferences and workshops, info days....

The Spanish team has been working closely with some of these centres for almost ten years. Several professional development courses have been organised together with them, and we keep a permanent contact with many of them. Over these years, we have detected that there is not a clear direction in the professional development policies for mathematics and science teachers. That results in an eclectic offer of PD

courses, which might vary from one centre to another, from one year to other. Normally, courses do not take longer than some days, distributed in a few months, and then the support disappears.

As a consequence, many teachers have the feeling that PD courses are useless, they feel disoriented about the kind of professional competencies they should be developing, and PD courses have little transformative impact on their daily teaching practices.

This diagnostic has been validated through discussions with policy makers within the Regional Ministry of Education. They recognise that there is a general picture of the teachers they want within the system, and that their professional development policies are oriented towards this general profile. But when coming down into the teaching of specific subjects, and particularly when thinking in mathematics and science teachers, this picture seems to be vaguer.

We thought that this is a key point to be addressed in our National Policy Workshop. Particularly, the workshop could be organised around the following questions:

- What is the kind of mathematics and/or science teacher we want within the Andalusian educational system?
- What are the professional competencies he or she should have? Which of these competencies are specific of being mathematics and/or science teacher?
- How could public resources and policies be reoriented to help teachers in developing their professional competencies towards this ideal picture?
- What specific actions could be taken in this direction?

2.2 Implementation of national policy workshop

Once the topic and the key policy makers were identified, the organisation and implementation of the National Policy Workshop followed the structure of a meeting organised around the previous key questions.

Before the meeting, several phone and email contacts took place with Mrs. Luisa López Gómez, as a part of our NAB. She helped us in getting in contact with other key policy makers within the Regional Ministry, and also to identify Ministry's priorities and potential actions that could be discussed during the workshop.

Finally, the meeting was organised for the 19th of March, within the main building of the Regional Ministry of Education in Seville. It lasted for 3 hours, in which an intensive and productive discussion with policy makers took place.

2.3 Problems/issues arisen during the implementation

In the organisation of the workshop, our main challenge was to attract those policy makers within the Regional Ministry of Education that could be really supportive with Mascil aims. In this sense, the collaboration of our NAB member was quite important. During the implementation, we had to deal with the fact that Regional elections were going to take place in the next weekend, which might lead to a change in the government. Although discussion were quite interesting, and a high commitment of policy makers was found, all of us were aware of that any decision had to be postponed until the new government was formed.

3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

The NPW took place within the main building of the Regional Ministry of Education. Previously, we have had some discussions with a representative from the Ministry, during NAB meetings and when she attended to the Mascil midterm conference. Since the publication of the 2006 reform, education has been oriented towards competencies, and this seems to be quite established 9 years after. Indeed, the last reform (2012) does not question this approach, at least in its basic assumptions. Besides, inquiry-oriented approaches to the teaching and learning of science and mathematics are more clearly mentioned in the new curriculum.

Almost ten years after the inclusion of competencies in education, changes in real classroom practices are still progressing slowly. Many professional development courses have been organised within Andalusia, focusing on the kind of knowledge and skills teachers need to implement a competencies-oriented curriculum. However, there is a lack of specific policies that could guide the planning of these professional development activities in the specific case of mathematics and science teaching and learning.

On the other side, the Regional Government has been developing and testing innovative “Educational Plans and Programs”, in cross-curricular subjects like reading, health habits or environmental education, among others. Although there are differences between these programs, most of them share a common philosophy:

- Plans and programs are supposed to be affecting schools as whole, or at least important areas within it (like the teaching in some curricular areas).
- Schools have to apply for these programs.
- For a school to be selected, the previous commitment of a percentage of teachers is needed, which can vary depending on the features of the programme.
- If the school is selected, a teacher within this school is designated as coordinator.
- There is specific training, both for coordinators and for the teachers involved in the programme.
- Teachers are supposed to implement innovations according to the programme, and they get support (like specific materials, guidance from experts, training courses...).
- The impact of the programme is evaluated, normally every year.

Within this context, it was the aim of our workshop to explore with policy makers a possible reorientation in the professional development policies of science and mathematics teaches, both in primary and secondary education, through the setting up of an experimental “programme” within the already existing “plans and programmes” scheme.

3.2 Themes and issues discussed

First of all, we carried out a general presentation of Mascil and its aim. We focused, specifically, in the connections between IBL and the development of students’ mathematical and scientific competencies. Also in the role the world of work can play in enhancing students’ motivation, and in creating an awareness of the use of mathematics and science beyond school. This short presentation ended highlighting

teacher professional development as a key factor for the spreading innovations in education.

That led to an open discussion about existing policies that orientate the professional development of teachers offered through the Teachers Centres network. Within this discussion, it became clear how the provision of professional development has been evolving in the last decades. Years ago, most of the activities took the form of out-of-school training courses, with a limited impact in classroom practices. This situation has been changing gradually. On the one hand, most of the courses now include a follow-up period in which teacher have to implement new methodologies in their classes and report back. On the other hand, in-school professional development has been prioritised, encouraging teachers groups and professional learning communities. Actions carried out within the “plans and programmes” scheme are, in part, a consequence of this evolution.

Third, it was discussed whether there were specific policies in relation with the professional development of mathematics and science teachers. In this sense, it became clear that, while there is an overall policy that draws a general picture of the kind of teachers the system is aiming at, there are not concrete orientations in relation with specific skills and methodologies teachers should have as mathematics and science teachers.

Finally, the conversation moved into the possibility of creating a specific “programme”, mainly for mathematics teachers. The programme could cover some dimensions of being a mathematics teacher that wants to be promoted from the Regional Ministry of Education. Somehow, the programme could be seen as a way of making policies in relation with the teaching of mathematics within Primary and Secondary schools in Andalusia more concrete. This programme could include different strands. For instance, in the case of Primary Education, one strand will be the learning of arithmetic based on the ABN method (ABN stands for “algorithms based in numbers”), which has become increasingly popular in Andalusian schools in the last 5-6 years. Another strand, both for Primary and Secondary schools, would be enriching mathematics teaching through the use of inquiry and problem solving. This is the one Mascil could be responsible of.

As a first step, it was decided to go on working once the new government was formed, and to start next year with a piloting face, which will include a limited number of schools. After the evaluation of this piloting phase, an optimisation of the programme will be made, and it will be decided whether it can be offered, as an optional plan, to all Primary and Secondary schools in Andalusia.

3.3 Recommendations

- i. Progressing in the definition of a mathematics and science teacher profile within the educational system in Andalusia, coherent with current policies.
- ii. Orientating professional development policies and actions towards this ideal profile.
- iii. Undertaking specific actions to promote the professional development of teachers in the desired direction.
- iv. Creating a specific programme, within Regional Ministry’s of Education “plans and programmes” scheme, to support schools in enriching their pedagogies with a wider uptake of inquiry-based approaches.

4. SUMMARY AND CONCLUSION

After a prior analysis of current educational and teacher professional development policies within the region of Andalusia, important gaps were found. These were considered as the starting point for planning the national policy workshop.

Among them, the gap between curricular dispositions (competency-oriented, including inquiry and problem solving approaches), on the one hand, and current teaching practices (still very traditional, with a very limited presence of IBL activities), on the other hand. This calls for specific actions specially focusing on the professional development of mathematics and science teachers.

This tension was specifically discussed in our policy workshop, with the aim of finding solutions that could go beyond the promotion of teacher training courses, and also with the aim of progressing in the definition of a specific profile of mathematics and science teachers within Andalusian educational system. Questions that guided our workshop were:

- What is the kind of mathematics and/or science teacher we want within the Andalusian educational system?
- What are the professional competencies he or she should have? Which of these competencies are specific of being mathematics and/or science teacher?
- How could public resources and policies be reoriented to help teachers in developing their professional competencies towards this ideal picture?
- What specific actions could be taken in this direction?

From the prior analysis, we came up with the possibility of exploring the “plans and programmes” actions. These seems to be specially powerful because they go beyond isolated teachers, trying to involved schools in the adoption of innovative actions. They also include professional development, as well as teachers’ commitment of implementing innovations in school. Besides, these programmes are monitored, and evaluated at the end of the school year.

This initial diagnostic orientated the definition of our workshop, the policy makers that were invited, and also the overall discussion.

The workshop can be labelled as successful. Important synergies between Mascil and policy makers’ aims were found, and the workshop resulted in the common agreement: exploring the setting up of a specific “programme” for the teaching of mathematics in Primary and Secondary schools within Andalusia. Initially, there would be a piloting phase, with a restricted number of schools, and the programme and its results will be evaluated afterwards. Then, it will be discussed whether it could be offered to other schools in Andalusia.

1.6 National Policy Paper : Cyprus

Nilolas Mousoulides & Maria Evagorou

1. INTRODUCTION

The purpose of WP2 is to give insights into opportunities and concerns to implement inquiry-based learning in mathematics and science, and make the connection to the world of work and everyday science and mathematics. Furthermore, an additional purpose of WP2 is to explore possibilities to involve and include policy makers in our work, and to convince policy makers in Cyprus on the importance of including inquiry based learning and the world of work. As part of WP2 each partner country was required to design and implement National Policy Workshops with the aim of informing policy makers on issues relating to Mascil, and how Mascil activities can be included in the teaching of mathematics and science

1.2. Aim and Structure of the document

The purpose of the National Policy Workshops in Cyprus was to explore possibilities to involve and include policy makers in our work, and to convince policy makers in Cyprus on the importance of including inquiry based learning and the world of work. This paper presents the structure and process of the National Policy Workshops that were implemented in Cyprus, along with the main themes that came out from the implementation.

2. APPROACH AND METHODOLOGY

Our group originally intended to bring together a number of policy makers from different groups (e.g. curriculum developers, Ministry of Education administrators, teacher trainers, administrators from the Cyprus Pedagogical Institute) to work together during a whole day workshop. Our effort to bring all the policy makers together proved that this was not easy because of the different time-schedules of the people invited. Therefore, it was decided to form sub-groups of policy makers and have separate workshops for each sub-group. Specifically, the following three groups were formed for the purposes of our National Policy Workshops:

- **Group 1:** Head policy makers from ministry of education (Director of CPI, head of the Professional Development Unit of CPI⁵, Head of the Directorate of Elementary Education, Ministry of Education, Director of the Directorate of Technical Education)
- **Group 2:** Science and Mathematics Inspectors (elementary and secondary)
- **Group 3:** Academics and seconded experts involved in the design of the new textbooks in science and mathematics

Materials, presentations and supporting documents were prepared for the workshops and were adapted based on the audience of each group. National Policy Workshops in Cyprus took place from January to May.

⁵ Cyprus Pedagogical Institute, from now on CPI

2.1 Rationale for selection of policy makers

Policy makers from all levels of hierarchy were invited to the local National Policy Workshops (high and mid-level administrators from the Ministry of Education and the CPI, curriculum developers and inspectors). The decision was based on the fact that people from different hierarchies are involved in different processes and can potentially support us in understanding how Mascil can inform policy in Cyprus.

Furthermore, policy makers from across the educational system (primary, secondary, middle school, technical education, teacher education) were invited. The decision was based on the fact that Mascil activities cover a range of ages, and are definitely linked to technical education as well. Therefore bringing together policy makers across the educational system would help bring up themes that are common or different in each educational stages.

2.2 Rationale for selection of specific issues for discussion

The decision of specific issues for discussion during the workshops was based on the groups of policy makers that were selected, and having in mind that the purpose of the National Policy Workshop was to explore possibilities to involve and include policy makers in our work, and to convince policy makers in Cyprus on the importance of including inquiry based learning and the world of work. Therefore, the issues for discussion were the following:

- (a) **Inquiry-based learning in science and mathematics and links to our curriculum**: The rationale for choosing this topic is based on the fact that IBL is under emphasis in the new curriculum that was introduced in Cyprus in science and mathematics. Despite the introduction of IBL as part of the theoretical framework of the curriculum, transforming IBL first into teaching materials, and then into teaching practice has been challenging. Therefore the choice of this theme was based on the fact that policy makers are involved and have been thinking about problems, and furthermore Mascil could offer solutions. The issue of using Mascil activities, or modified activities from Mascil as part of the textbooks that are currently being designed for mathematics and science was also part of this theme.
- (b) **World of work as part of science and mathematics**: This topic was chosen because it is part of the Mascil project, it is considered of great importance, but is often ignored in the teaching of these subjects. The aim of introducing this theme for discussion was to familiarize the policy makers with the world of work and record their reactions, concerns and thoughts about introducing WoW as part of the teaching of mathematics and science.
- (c) **Assessment of IBL and issues we face locally**: This topic was chosen because of the concurrent discussions around assessment in IBL and the interest that policy makers have in assessment and student outcomes. The aim of this theme was to exchange ideas on how to assess IBL.
- (d) **Teacher training on IBL and WoW in mathematics and science**: This theme was chosen because based on the literature, teacher professional development is important for the success of any new initiative in teaching.

Despite of the importance of teacher training, this was initially ignored during the reform of the Cypriot educational system. Therefore, by discussing this issue with policy makers across the educational system we hoped to influence them on further promoting teacher training.

2.3 Implementation of national policy workshops

As mentioned above, we implemented more than one workshops to accommodate the schedules of all policy makers involved in the process. The different workshops had different durations, and for some of the groups we had more than one meetings. Specifically, the implementation was as follows:

- **Group 1:** We only had one meeting that was 2 hours long. The meeting took place in March 3rd at the premises of the Cyprus Pedagogical Institute (CPI). Four policy makers (Dr A. Michaelidou-Evripidou, Director of the CPI, Dr P. Hadjitheodoulou, Head of the Training Sector, CPI, Mr E. Neocleous, Director of Elementary Education, and Dr E. Markadjis, Director of Technical and Professional Education an member of the Cyprus NAB) and two researchers from Mascil (Dr M. Evagorou and Dr N. Mousoulides) were involved.
- **Group 2:** We had two meetings, 2 hours long for each meeting. The meetings took place in April 17th and May 5th with seven school inspectors. Two inspectors from general elementary (Dr K. Hambiaouris, Mr K. Charidimou), 1 physics (Mr G. Aslanides), 1 chemistry (Mr G. Neophytou), 1 biology (Dr D. Mappouras), 1 mathematics (Mr S. Theophilou) and 1 from technical school (Mr C. Georgiou) participated in each one of the meetings, along with Dr M. Evagorou and Dr N. Mousoulides. The meetings took place at the premises of the University of Nicosia.
- **Group 3:** We had one meeting that was 3 hours long. The meeting took place in May 11th with 4 participants that are involved in the design of the new textbooks for science and mathematics in Cyprus (Mr G. Karmiotes, Mr G. Tsalakos, Mr A. Karamichali, and Dr E. Papparistodemou). The meeting took place at the premises of the University of Nicosia.

2.4 Problems/issues arisen during the implementation

Overall no problems had arisen during the implementation of the National Policy Workshops. The only problem we had identified was bringing together all policy makers because of their schedules. Nevertheless, our solution to have more than one National Policy Workshops with different groups of participants had proven beneficial since we were able to have more in-depth and focused discussions with the homogenous groups.

3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

As mentioned earlier, Cyprus implemented more than one National Policy Workshop with the different groups of policy makers. Specifically, four workshops were organized to accommodate the discussions of the three groups that we formed. During the workshops we presented the main ideas behind Mascil (IBL and WoW) and some examples from the designed activities. Then the participants were provided a list with the themes as listed below:

- Inquiry-based learning in science and mathematics and links to our curriculum
- World of work as part of science and mathematics
- Assessment of IBL and issues we face locally
- Teacher training on IBL and WoW in mathematics and science

As the themes were presented the participants were invited to comment, offer their opinion or discuss concerns. The research group coordinated the discussions and noted important themes that came out from the discussion.

3.2 Themes and issues discussed

The purpose of the National Policy Workshops in Cyprus was to explore possibilities to involve and include policy makers in our work, and to convince policy makers in Cyprus on the importance of including inquiry based learning and the world of work. Four workshops with three different groups of policy makers were implemented in Cyprus from March to May. The main findings from the workshops were:

- (a) IBL is important and is included in the teaching of science and mathematics already – more efforts to have it implemented are necessary,
- (b) Teachers should be trained on how to engage their students in IBL activities in both mathematics and science – recommendations to use Mascil materials for teacher professional development under the auspices of CPI were made.
- (c) The new textbooks are designed around IBL – Mascil activities cannot be included in the actual textbooks because they are already in final design stages but the policy makers agreed that some of the Mascil activities are useful and could be used by the teachers as an alternative.
- (d) Not everyone in the groups had the same understanding of IBL, and especially science and mathematics representatives have different notions of IBL. It will be necessary in future meetings to present a coherent definition of IBL for all participants.
- (e) The World of Work is not part of the Cypriot curriculum, but linking mathematics and science to everyday life is an important aspect of the new curriculum. Therefore one recommendation is to present WoW as part of connections to everyday life to convince the teachers to use Mascil materials in their classes.
- (f) Assessing IBL in mathematics and science is not straightforward because the skills that are developed are not easily assessed through written exams. Policy makers (Group 1) insist on finding ways to assess through written tests. Recommendations include working on assessment ways as part of our workshops with teachers.

3.3 Recommendations

Based on the discussions from the 4 workshops, the following recommendations came out:

- (a) More efforts to implement IBL in the classroom should be coordinated by the different policy makers involved,
- (b) Recommendations to use Mascil materials for teacher professional development under the auspices of CPI were made.
- (c) Mascil activities are useful and could be used by the teachers as an alternative to some activities included in the textbooks.
- (d) In future meetings it will be necessary in future meetings to present a coherent definition of IBL for all participants since not everyone had the same understanding of IBL.
- (e) One recommendation is to present WoW as part of connections to everyday life to convince the teachers to use Mascil materials in their classes.
- (f) Recommendations include working on assessment ways as part of our workshops with teachers.

4. SUMMARY AND CONCLUSION

The National Policy Workshops in Cyprus aimed to inform policy makers about Mascil, to explore possibilities in actively involving policy makers in our work, and to convince policy makers in Cyprus on the importance of including inquiry based learning and the world of work in the mathematics and science curricula and teacher training in Cyprus.

Based on the discussions that took place during the meetings, the outcomes and the agreements (e.g., offer a joint in-service training course) between the invited policy makers and the Mascil researchers, we believe that the meetings had a significant impact and can be considered as very successful.

1.7 National Policy Paper : Norway

Ragnhild Lyngved Staberg

1. INTRODUCTION

1.1 Overview of work package 2

WP2 aims to give insights into the strengths, weaknesses, opportunities and threats of Inquiry Based Science and Mathematics implementation from a context perspective. Second, the activities in WP2 focus on cooperation and synergies among research, policy and practice fields, producing strategies to support the more widespread uptake of inquiry-based science teaching (IBST). National working papers on analysis of policy context report on the educational systems and the policy contexts in all 13 partnership nations. They also highlight the contextual factors that support or hinder a widespread implementation of inquiry based science teaching (IBST) in vocational contexts.

In Norway there is a general supportive context for the implementation of the project and for the achievement of the mascil objectives. In relation to wider policy perspectives, policy documents state that the connection between schooling/teaching and industry should be strengthened, and teaching should be made more relevant for students. Priority is also given to inquiry-based methodology both in sciences and mathematics. At a school and classroom level though, it seems that teachers find it hard to adjust to the propositions (see Deliverable N° 2.1, mascil).

Norwegian teachers see time as the main hindrance for implementation of IBST⁶ and World of work (WoW)-related approaches: «*To facilitate the increased use of IBL strategies, teachers believe that they need more, and more relevant, continuous professional development courses....teachers need to be given more time to implement IBL in their classrooms and more time to collaborate with their colleagues*». Results from the mascil pre-questionnaires (N=103) show that 49,5 % of the teachers feel confident with IBL whilst 50,5 % don't, 72,8 % say there is too little time available to plan and prepare IBL lessons, and 95 % say they would like to implement more IBL practices in their lessons. Concerning WoW related approaches 94 % of the teachers say that students like them, but only 27,5 % feel confident working with them. 87,2 % would like to make more connections to the WoW in their teaching, but 79 % mean there is too little time available to plan and prepare WoW related lessons.

The content of this national policy paper revolves around the question as to what can be done on national/international level to motivate policy to support the widespread implementation of IBST.

⁶ Sikko, S.A., Lyngved, R. & Pepin, B. (2012) Working with Mathematics and Science Teachers on IBL Approaches: Teacher Concerns. *Acta Didaktika Norge*, Vol 6(1): 118/18.

1.2 Summary of national policy paper

The Norwegian mascil policy workshop “Mascil Building Bridges” was held in Trondheim February 27th, 2015. This was a follow-up event of a similar workshop held in Trondheim January 20th, 2014 (in collaboration with the EU project INSTEM). The two seminars were entitled “Building Bridges”, referring to the need for connecting the European projects in science and mathematics education at the national level. The mascil Building Bridges event was hosted by Sør-Trøndelag University College (HiST) - see attachment 1 and 2.

The seminar was administered by the mascil team at HiST, Professor Birgit Pepin, HiST/Eindhoven (Norwegian coordinator of PRIMAS and mascil) and Professor Peter van Marion, Norwegian University of Science and Technology (NTNU) (Coordinator of S-TEAM, Norwegian coordinator of INSTEM).

The list of participants (see page 4-5) includes researchers in science and mathematics education, teacher educators, school teachers, persons representing school owners (Trondheim Municipality, Sør-Trøndelag County), the Norwegian Centre for Mathematics Education, the Norwegian Centre for Science Education, the National Centre for Science Recruitment, the Ministry of Education and Research and national initiatives/projects like FYR⁷, Lektor 2⁸, Rollemodell⁹. In addition Peter Gray, INSTEM, and Geoffrey Wake, mascil, were invited guest speakers.

The aim of the policy workshop was to discuss teacher education, professional development and development of the profession, with regard to mathematics and science education; and the use of Inquiry Based Science Teaching and World of Work approaches. The program of the seminar is given in attachment 3.

The main outcomes were: we managed to consolidate the importance of IBST and WoW approaches amongst the teacher education community; to disseminate the importance of such approaches to school and government authorities; and emphasise the important role mascil plays in this. In particular, we were able to engage the Norwegian Ministry of Education and Research through their representative at the workshop, we improved the connection between HiST and the Ministry; and we established a vision for more cooperation and alignment of projects with IBST and/or WoW approaches and discussed the opportunities for sharing resources.

2. APPROACH AND METHODOLOGY

2.1 Rationale for selection of policy makers

Process of planning

Mascil Building Bridges 2015 was a follow-up event of Building Bridges 2014, and the two workshops represent a local and national long-term plan for strengthening collaboration between projects geared towards IBL. The policy workshop was planned in cooperation with INSTEM, NTNU. During planning, we decided to invite the same policy makers that participated in the previous event, and to add those

⁷ <http://fyr.ndla.no/>

⁸ <http://www.lektor2.no/>

⁹ <http://www.rollemodell.no/>

related to world of work (industry, recruitment centres, initiatives like FYR, Lektor 2, Rollemodel). To have maximum impact on policy makers and motivation for participation, the dean of the Department for Teacher and Interpreter Education, HiST, sent out the invitations. Another strength was that we involved a guest speaker, Geoffrey Wake, School of Education, Univ. of Nottingham, who has been known to be especially experienced in teacher professional development and policy related issues. Peter Gray, Research manager from NTNU, project manager of S-TEAM and leader of S-TEAM WP10 was also invited because of his experiences in working within Educational Policy, Science Education and Pedagogic Theory. Dr Gray has been involved in European collaborative projects and teacher education since 2002 and he is co-convenor of the Teacher Education Research Network of EERA.

In addition to the participants suggested by the mascil team at HiST, INSTEM Norway and the dean at HiST had also suggested a variety of participants. In total there were 23 participants at the workshop. Since policy makers and school leaders usually are busy, we decided to send out invitations as early as possible; about 2 months ahead of the event.

The policy workshop provided an opportunity to discuss a long term plan for the region, to strengthen the collaboration between projects with similar goals, to establish better contact with our Ministry, local and regional authorities, and to increase policy makers' focus on science and mathematics education, in particular the implementation of IBL and WOW related approaches in these important subjects. One possible threat regarding the planning and implementation was the limited involvement of local school authorities, and thus too little involvement of principals/head teachers (1 out of 13).

Networking process, stakeholders' engagement

National centres (math, science, recruiting to sciences) were represented, and so were the Norwegian Ministry of Education and Research (KD), Sør-Trøndelag County, Trondheim municipality, and 1 head teacher. Even though the intention for the 2015 policy workshop was to build on the previous workshop in 2014, we experienced a lack of continuity. Some participants from the Building Bridges 2014 workshop were unable to attend this year's workshop, including representatives from the Directorate for Education and Training, and both the Ministry and the county sent new representatives. At any given time there were several projects fighting for attention, so building stable and solid connections to important parts of the political authorities at all levels must be seen as an important future task. In that way it would be easier for those people to see the importance of attending workshops like the Building Bridges event.

2.2 Rationale for selection of specific issues for discussion

Outcomes from Building bridges 2014 were taken into consideration when issues for discussion for the 2015 event were selected. The points of view that were expressed in last years' event are presented below:

1. The nature of inquiry – or inquiry-based learning in science and mathematics
2. “Inquiry” is more clearly present in the curriculum for science than in mathematics
3. Inquiry-based science education (IBSE) alone is not the answer. Improving classroom practice is more a question of being reflective as a teacher
4. The importance of subject knowledge and didactic knowledge in inquiry-based approaches
5. The basis for educational change should be laid in pre-service (initial) teacher training and through empowerment of those teachers already working in schools.
6. A need for collaborative networks
7. Continuous input for teachers: life-long-learning
8. European projects may only reach out to a few teacher trainers and teachers
9. Teacher trainers need to be trained
10. Valuable input through EU-projects
11. Knowledge from EU-projects

Based on reflections around these 11 themes/concerns, our issue for discussion was: *What can be done on national level to motivate policy to support the widespread implementation of IBST?*

2.3 Implementation of national policy workshops

Invitations were sent via email in December 2014, and 23 out of 48 invited persons attended the workshop. The workshop was arranged as a ½ day meeting at HiST, 27th February 2015 at 9.30-12.30. The second half of the day a NAB meeting was held. Presentations were provided by the mascil team and the invited guest speaker Geoffrey Wake. Group discussions organised in mixed groups (see colour coded list of participants, attachment 3) and a plenary discussion towards the end, which mainly consisted of presentations from the group work. The plenary was tape-recorded and pictures from the event were taken. The policy workshop was arranged as a face-to-face meeting, which presupposed that people had to be physically present. Those who couldn't travel were not able to attend. It was presumed that in face-to-face meetings it would be easier to get to know each other, to engage and discuss actively. Below is the final list of participants.

List of participants

NAME		INSTITUTION
1. Peter Gray	Research Manager	Norwegian University of Science and Technology
2. Geoffrey Wake	Associate Professor	School of Education, Univ. of Nottingham
3. Lene Oftedal	Senior advisor	Norwegian Ministry of Education and Research
4. Inger Sagen Hasselo	Principal	Trondheim Municipality, Saupstad school
5. Kjersti Wæge	Director	Norwegian Centre for Mathematics Education

6. Peter van Marion	Professor, director	Norwegian University of Science and Technology, Skolelaboratoriet
7. Per-Odd Eggen	Associate Professor	Norwegian University of Science and Technology, Skolelaboratoriet
8. Ingeborg Ranøyen	STEM-Coordinator	Trondheim Municipality
9. Morten Sørli	Advisor, Project leader	National Centre for Science Recruitment, Rollemodell and hvakanjegblimedreal.fag.no
10. Borghild Lundebj	Director	National Centre for Science Recruitment
11. Tarjei Joar Moen	Advisor, Upper secondary educ.	Sør-Trøndelag County
12. Kristine Bakkemo Kostøl	Project leader, Lektor 2	Norwegian Centre for Science Education
13. Berit Reitan	National Project leader	Norwegian Centre for Science Education FYR science
14. Jens Arne Meistad	National Project leader	Norwegian Centre for Mathematics Education, FYR mathematics
15. Ingrid Næss	Teacher	Trondheim Municipality, Sunnland school
16. Camilla Normann Justnes	Teacher	Trondheim Municipality, Saupstad school
17. Camilla Trud Nereid	Dean	Sør-Trøndelag University College (Teacher education)
18. Birgit Pepin	Professor	Eindhoven School of Education, Eindhoven University of Technology / Sør-Trøndelag University College
19. Heidi Dahl	Associate Professor	Sør-Trøndelag University College (Teacher education)
20. Maria I. M. Febri	Associate Professor	Sør-Trøndelag University College (Teacher education)
21. Jardar Cyvin	Associate Professor	Sør-Trøndelag University College (Teacher education)
22. Svein Arne Sikko	Associate Professor	Sør-Trøndelag University College (Teacher education)
23. Ragnhild Lyngved Staberg	Associate Professor	Sør-Trøndelag University College (Teacher education)

2.4 Problems/issues arisen during the implementation

The first issue raised was the importance of continuity. It was therefore decided to include the coordinators of the Building Bridges 2014 workshop in the planning of the 2015 meeting. This would also ensure the participation of related EU-projects, since the 2014 meeting was a collaboration between mascil and INSTEM and S-TEAM.

An important issue arising during the implementation of the policy workshop was the participation of important policy stakeholders and school authorities. As different projects (and their leaders) were present at the event, it was necessary to build good relations with influential key people who might help involving the relevant policy makers. At HIST, the dean Dr. Camilla Nereid was such a key person, and fortunately she agreed to help with the invitations and arrangements of the workshop.

Teachers are key stakeholders in the implementation of new ideas and pedagogies in school, and to ensure teachers' willingness to engage in professional development, it is mandatory to engage school owners and head teachers. It was therefore decided to invite relevant key persons at local and district level to the workshop as well as head teachers. Unfortunately, it turned out that fewer of these people than we would have wished were able to attend the workshop.

3. DOCUMENTATION OF THE WORKSHOP

3.1 Themes and issues discussed

The expected outcome of the discussion during the national policy workshops revolved around the overarching question: *What can be done on national/international levels to motivate policy to support the widespread implementation of inquiry-based science teaching?* From this question, we derived the following questions for group discussion:

- In which ways can policy makers, teacher educators and schools/teachers work together more closely, in order to get the most benefit from projects like mascil?
- In which ways are projects like mascil useful for schools and teachers?
- What are the benefits for Norway: what are the 'lasting benefits'/what is the 'lasting impact' of projects like mascil, in terms of
 - Professional development of mathematics and science teachers and the scaling of the professional development?
 - IBST?
 - Linking schooling (e.g. subjects) and the world of work?

The results of the discussion are presented below.

3.2 Recommendations

The main outcomes of the group discussion in the policy workshop were connected to

- the importance of establishing and maintaining professional networks and structures at different levels: Within-school, between-schools and between-projects level;
- the importance of vision alignment at those levels, and
- the roles both national and local policy makers play

At within-school level, we have gained insights into the positive impact of IBST on students' learning of mathematics and science. Teachers and multipliers involved in the mascil project and other related projects promoting IBST, through the professional development, report that they have learnt how to reflect and share/communicate with each other, in order to spread the implementation of IBST to all mathematics and science teachers in the collegium. From the policy workshop, *the crucial role teacher networks within school play in order to sustain the implementation of IBST beyond the project's lifetime* became clear. For this to happen, it is important

that school leaders are knowledgeable about the implementation and its processes, and that teachers receive continuous support both from school leaders (head masters) and from local policy makers (County, municipality). Such support can be provided, for instance, by providing adequate amount of time (see § 1.1.) and by facilitating/promoting/ encouraging the development of such communities of practice in every school.

We have also gained insight that this work involves deep and long term cultural changes in schools. It is thus *highly beneficial that schools work in collaboration with other schools*. Therefore the importance of the professional networks at between-schools level or communities of schools. At this level there is the need for policy makers, both local and national, to play a more active role in providing structures and incentives. An example for this is to establish a system of ‘expert teachers’ in individual or communities of schools. Further, it would also be highly beneficial to closely align the vision of local and national policy makers to the widespread implementation of inquiry-based science teaching.

In order to make the alignment of vision more clear, it is important *that policy documents support inquiry based science teaching*, for instance IBST should be made more explicit in the curriculum and other strategic documents. As importantly, it is crucial to establish an assessment system that is related to IBST. The national policy makers are thus expected to play a significant role in this regard.

Further, the importance of *IBST and WoW approaches should systematically be included and consolidated in the initial teacher training*. New teachers equipped with this competency can implement the idea, work with it throughout their career and/or become ‘expert teachers’. To implement this at a national level, policy makers at all levels need to play a more active role in supporting the facilitation at national, regional and school level.

This policy workshop was a follow-up of the “Building Bridges” seminar in 2014 motivated by the need for connecting the European projects in science and mathematics educations at the national level (see § 1.2.). One of the important outcomes of the workshop was that we *established a vision for strengthening professional networks between European projects with IBST and/or WoW approaches*, thus more cooperation and alignment across these projects in Norway, including mascil, for instance through sharing of resources. Such alignment will be strongly beneficial for long lasting and widespread impact of European projects such as mascil.

4. SUMMARY AND CONCLUSION

The Norwegian Policy Workshop 2015 took place in Trondheim on February 27th with a total of 23 participants, including representatives from local, county and national level school authorities, national centres for mathematic, for science and for science recruitment, national mathematics and science educational initiative projects, researchers in science and mathematics education, and school teachers. The workshop was a follow up to the 2014 Building Bridges, and thus was in line with the explicit goal of the Norwegian mascil team to build and sustain continuity amongst colleagues working in teacher education and school stakeholders and policy makers on the issues of IBST.

An important outcome of the workshop was the consolidation of the importance of IBST and WoW approaches amongst the teacher education community, dissemination of the importance of such approaches to school and government authorities and the underlining of the important role mascil plays in this. In particular, the participation and engagement of the Norwegian Ministry of Education and Research through their representative at the workshop, was an important outcome.

Furthermore, the establishment of a vision for more cooperation and alignment of projects with IBST and/or WoW approaches, was an important outcome; in particular regarding opportunities for sharing resources across and between projects and the national centres.

For IBST and WoW approaches to become an integrated part of teaching in mathematics and science, a 'culture change' appears to be necessary. Such change relies on the active participation of the communities of teachers in schools. This can only be accomplished through the active facilitation by school authorities at all levels, by providing the necessary resources, not least by setting off adequate time for teachers to engage in professional development and collegial communities of practice.

The way subjects are taught in school is to a large extent dependent on what is assessed in exams. To advance the uptake of IBST and WoW –related approaches, it is therefore essential that the national curricula and examinations acknowledge and reward inquiry as an important part of what constitutes knowledge in the mathematics and science subjects.

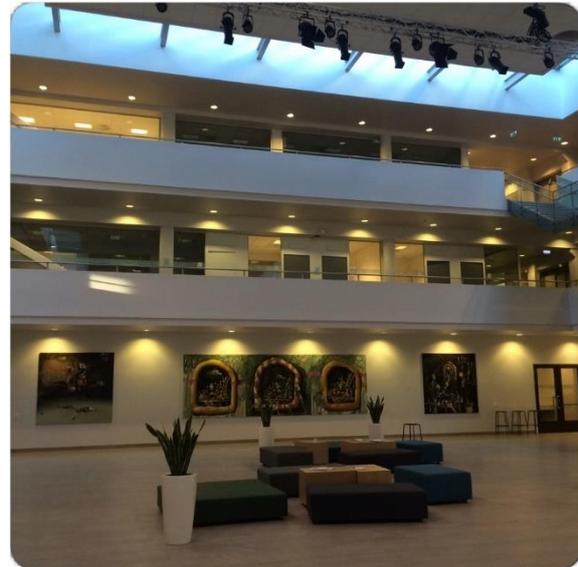
ATTACHMENT 1: Pictures from the Norwegian Policy Workshop





ATTACHMENT 2: Pictures from the Venue

Venue: HiST, Handelshøgskolen, Klæbuveien 72, Room ELG-U33
Location: See Campus Elgeseter; <https://hist.no/content/84022/Campus-Elgeseter>





Velkommen til policy workshop: Mascil Building bridges

Tid: Fredag 27.februar kl. 09.30-12.30

Sted: HiST, Handelshøgskolen, Klæbuveien 72, Rom ELG-U33

Program

- 09.30 Velkomst v/ Camilla Trud Nereid, dekan, HiST, ALT
Introduksjon til dagens workshop og *mascil* prosjektet v/Ragnhild L. Staberg. Kort presentasjon av deltakere
- 09.45 Teacher professional development & development of the profession v/
Geoffrey Wake, Associate professor in Mathematics education, Faculty of
Social Sciences, School of Education, Univ. of Nottingham
- 10.30 Påfølgende diskusjon v/ Doris Jorde, direktør, Naturfagsenteret
- 10.45 Pause
- 11.00 Gruppediskusjoner
- 11.45 Presentasjoner, syntese i plenum v/Birgit Pepin, professor i
matematikkdidaktikk, Eindhoven/HiST
- 12.30 Lunsj



List of participants

NAME

INSTITUTION

1. Peter Gray	Research Manager	Norwegian University of Science and Technology
2. Geoffrey Wake	Associate Professor	School of Education, Univ. of Nottingham
3. Lene Oftedal	Senior advisor	Norwegian Ministry of Education and Research
4. Doris Jorde	Professor , director	Norwegian Centre for Science Education
5. Kjersti Wæge	Director	Norwegian Centre for Mathematics Education
6. Peter van Marion	Professor, director	Norwegian University of Science and Technology, Skolelaboratoriet
7. Per-Odd Eggen	Associate Professor	Norwegian University of Science and Technology, Skolelaboratoriet
8. Ingeborg Ranøyen	STEM-Coordinator	Trondheim Municipality
9. Morten Sælle	Advisor, Project leader	National Centre for Science Recruitment, Rollemodell and hvakanjegblimedreal FAG.no
10. Borghild Lundeby	Director	National Centre for Science Recruitment
11. Tarjei Joar Moen	Advisor, Upper secondary educ.	Sør-Trøndelag County
12. Kristine Bakkemo Kosta	Project leader, Lektor 2	Norwegian Centre for Science Education
13. Berit Reitan	National Project leader	Norwegian Centre for Science Education FYR science
14. Jens Arne Meistad	National Project leader	Norwegian Centre for Mathematics Education, FYR mathematics
15. Ingrid Næss	Teacher	Trondheim Municipality, Sunnland school
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18. Birgit Pepin	Professor	Eindhoven School of Education, Eindhoven University of Technology / Sør-Trøndelag University College
19. Heidi Dahl	Associate Professor	Sør-Trøndelag University College (Teacher education)
20. Maria I. M. Febrì	Associate Professor	Sør-Trøndelag University College (Teacher education)
21. Svein Arne Sikke	Associate Professor	Sør-Trøndelag University College (Teacher education)
22. Ragnhild Lyngved Staberg	Associate Professor	Sør-Trøndelag University College (Teacher education)

SPØRSMÅL TIL GRUPPEDISKUSJON

- In which ways can policy makers, teacher educators and schools/teachers work together more closely, in order to get the most benefit from projects like MaSciL?
- In which ways are projects like MaSciL useful for schools and teachers?

- What are the benefits for Norway: what are the 'lasting benefits'/what is the 'lasting impact' of projects like MaSciL, in terms of
 - Professional development of mathematics and science teachers and the upscaling of the professional development?;
 - IBST?;
 - Linking schooling (e.g. subjects) and the world of work?

<http://www.mascil-project.eu/>

<http://mascil-norge.org/index.html>

<http://www.instem.tibs.at>

The mascil project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no 320 693

1.8 National Policy Paper : Romania

András Szilárd

1. INTRODUCTION

1.1 Overview of work package 2

In Romania the implementation of the Policy work package was realized on several different levels. On one hand we had a large event, the policy workshop, which was linked to a major regional contest involving more than 140 teachers including school masters, inspectors, university staff, inspectors from central administration (from the ministry of education). The event was open for all participants, but the stakeholders were invited separately. Finally the number of participants was around 80, with 47 stakeholders (inspectors, school directors). On the other hand we organized several small events in schools, where the school director, local stakeholders were invited to participate in IBL lessons with Mascil tasks or in presentations about such activities. These activities were organized with the help of teachers involved in the Mascil PD course. Depending on possibilities after these small events there were organized informal discussions with stakeholders.

All these events were prepared keeping in mind two main aspects: to provide local working examples (from piloting actions, PD courses, working with Mascil tasks) and to give an overview of the international aspects (recommendations, good practices). The first aspect raised a lot of extra issues regarding the provided examples: they had to be adaptable both in rural areas (with zero industry in the adjacent area) and in urban schools, they had to be strongly linked to the curricula (which is highly centralized), they had to be relevant to different student age groups, etc. In this way we had to correlate in a way the policy work package with the school activities, we needed a better documentation of these activities in order to be able to use the examples. The structure of the national policy paper provided some guidelines in all these activities.

1.2 Summary of national policy paper

In this short report we describe the activities of work package 2 in the Romanian context. This will interfere in some points with the activities of other work packages, due to the small events organized before the NPW, so we will emphasize also the mutual influence between WP2 and the other work packages. First we provide the rationale for focusing only on the low(or mid)-level policy makers, for the organization of several small events before having a large policy workshop, the choices we have done in the implementation of NPW, the themes and issues discussed. At the end we formulate some recommendations on local level and some conclusions regarding the whole work from WP2. The main hindering factor that was identified on local level is that local professionals do not have a relevant space to manifest neither as individuals nor as networks or professional associations. The Romanian educational system seems to have a schizophrenic behaviour: it is highly centralized (in terms of employing the teachers, in terms of curricula, of type of classes, etc.) with a lots of demands both for teachers, and local stakeholders and on the same time without creating the possibilities, the mechanisms that can help these categories to respond to these demands. Two more factors were also named: the rate of changes inside the

system is too big together with the average age of teachers and this increased rate lead to a high resistance on teachers side; inside the system the assessment of teachers' work is not correlated with the quality of the teaching process (it is aggregated from some administrative achievements, results of students on different contests, it is measured more quantitatively than qualitatively).

2. APPROACH AND METHODOLOGY

2.1 Rationale for selection of policy makers

The rate of change in the Romanian ministries is relatively high (7 different people acting as ministry of education in the last 5 years), moreover the last "law of education" voted in 2011, for which a huge number of methodologies were changed in the last 4 years, is going to be changed this year (2015). These changes do not cover curriculum changes, national examination changes that can be changed even during an ongoing school-year (at least this is the learned experience in the last few years). For this reason the Romanian Mascil team (according to the opinion of the National Advisory Board) chose to focus on low- or mid-level policy makers, school directors, inspectors, members in executive boards of schools, local stakeholders having strong connections with the schools (educational advisor for local council, etc.). This choice has advantages and disadvantages also. The low-level policy makers usually have a more personal impact on their social environment, so teachers can feel their support in a relatively short time frame, any other feedback is also on a shorter loop. On the other side, the local policy makers can't change (at least in the Romanian system) a lot of aspects in the administration, the curriculum etc., but they can support teachers to introduce optional courses, to organize out of school events, etc. At the current state of the Romanian education this seemed to be more important than having a top level support, without local financial or other support, that also easily can be understood (on teachers' side) as a new, compulsory requirement, that will last for a few months (hence it will never be evaluated coherently).

2.2 Rationale for selection of specific issues for discussion

The topics and the organizational frame was also fitted to school directors, inspectors and local policy makers and a key aspect was to create also the possibility of interactions between teachers and local stakeholders. This led to the organization of several small mixed-events that were like a dissemination event by the participation of several teachers, 1-2 school directors, members in executive boards, etc. In some of these activities the members of the Mascil team were present as coordinators, facilitators not as organizers. The teachers (involved in PD) presented their local examples, or simply they ran the activity and the members of the Mascil team added comments, viewpoints, research results during the formal or informal discussions that followed the activity. In most of the cases after the activity there was a short presentation of the teacher followed by a brief presentation of the Mascil team member and then all the teachers/stakeholders had the opportunity to raise issues, comment on presented issues or simply discuss about their thoughts. The event usually ended with an informal lunch, where the discussions were continued. In most of these cases the topics discussed included a few key issues from the Mascil team member and issues raised by the participating teachers, directors, inspectors. These small events were used as a kind of "brainstorming" in the preparation of the NPW, so the selected topics/issues were already based on the opinion of several teachers and stakeholders. In section 3.2 we present the discussions from one small event

(held in Capilnita, a small village) and the key points from the NPW held in Cluj Napoca.

2.3 Implementation of national policy workshops

The NPW was held in Cluj Napoca and it was linked to the regional contest Grigore Moisil on 27th of March 2015. It was divided into 2 parts, a presentation about IBL, WoW, local examples from Primas and Mascil followed up by several group discussions given topics. Two examples were presented from the local Mascil activities, the second one using a short video (The topographer activity, and Make your own nonstandard bookshelf activity). At the end each participants received (as a reminder) a book with IBL activities that was edited during the project Primas. After the formal meeting the members of Romanian Mascil team were also involved in several informal discussions with the participants.

2.4 Problems/issues arisen during the implementation

During the implementation there were 3 crucial steps: the first was to decide on the frame of NPW. Based on several negative experiences (where invited people confirmed their presence, but in the very last moment they cancelled) we didn't risk to organize a stand-alone event at Cluj, so we listed all major events in the given period and then thought about which one to combine with the Mascil workshop. One year earlier (march 2014) we had also a prolusion, when the Romanian Mascil team was involved in an international competition. We proposed to have a "Mascil-flavored" task in the competition and starting from this to have some discussions about IBL, WoW, etc. The task was about plane tilling (separate problems for each class in upper secondary) and each student received an envelope with some artefacts that could be useful in the solution. The problem was well accepted by students and teachers, but we were hardly criticized by the representatives of the ministry for "using the event in the scope of the project". For this reason the NPW was organized as a separated satellite event. The second step was the choice of the event, here we tried to maximize 3 things: the involvement of local firms and organizations, the number of stakeholders both from local and from national level, and the geographical covering. The third problem was the method of working: initially we wanted only small group discussions and a more informal atmosphere, but this was not feasible, so we had a presentation and the group work afterwards.



3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

The NPW started with a presentation right after the official opening ceremony of the event. At the opening ceremony several talks were given by representatives of business medium (e.g. the director of a local bank, a representative from a computer science company) and by inspectors from Cluj county and from central administration. The Mascil presentation and group discussions was the closing part of this ceremony. The presentation was given by Szilárd András, member of the Mascil team and focused on the understanding of 4 key elements: what is IBL?, what is WoW?, how are these implemented in Mascil?, what local examples, good practise exists? The last point of the presentation was the presentation of a short video about a Mascil task and some questions were formulated for group discussion. These questions were:

1. How can you, in your position help teachers implementing IBL and WoW?
2. What suggestions can you formulate for national policy makers in order to support implementing IBL and WoW?
3. What obstacles do you see in the Romanian educational system from the viewpoint of implementing IBL and WoW on a regularly basis?
4. What do you think teachers need for improving their teaching?

3.2 Themes and issues discussed

In what follows we present the topics from a small event and from the NPW. The following themes and issues were discussed after an activity and a presentation (at the activity the director, a teacher involved in teacher training participated as

observer, at the following presentation there were 18 teachers half of them from the neighbouring village, an inspector, the school director from the neighbouring village, 3 persons from the executive board of 2 different schools, 1 person from the local council):

1. (for teachers, raised by teachers) What can you do in order to help students in engaging learning activities?
 - Some of the opinions, shared experiences: organise activities, not just lessons; build on the curiosity of the students in choosing the contexts of the activities (prof. Csenger Zsuzsánna presented several activities designed as response to students' demands);
2. (for teachers, raised by teachers) How can you respond to students demands regarding the content of learning process if you have a fixed curriculum?
 - Some of the opinions: by making strong connections between content from curriculum and IBL activities, by involving professionals from different areas as consultants (parents are always available)
3. (for directors, raised by teachers) Can you support financially extracurricular activities, or the generated costs must be covered by teachers or by parents?
 - Conclusion: Generally the school's budget can't cover extra expenses (extra means other than the salary of the teacher and the regular bills for the school), but near the school there is the parents' committee, which can help in these problems. In some lucky cases also the school can help by including the expenses in the annual plans, but this needs a lot of administration in advance and it is not flexible.
4. (for directors, raised by teachers) How can you support teachers in improving the quality of their teaching? Can you employ auxiliary personnel that help the learning process (not the doorman, the mechanic or the cleaning service)?
 - Answers: In the last years appeared a possibility to use fixed term contracts, but it is almost impossible to have professional auxiliary personnel (e.g. in labs) in smaller schools. Unfortunately during the inspections it is a too big emphasis on administrative, formal aspects and the school directors and the local administration has too little influence on salaries (these are regulated nationally). So the impact on quality of teaching in most of the cases is based on the personnel relation between directors and teachers, the system do not provide really stimulating tools.

The following themes and issues were discussed in the groups of NPW (some of them were added to the initial 4 questions during the group work), some opinions from small events were expound during these discussions:

1. What obstacles, hindering factors do you see in using IBL, WoW?

- the examination system (national tests, etc.) is not using IBL, more generally teachers as professionals do not have sufficient autonomy.
2. What do you think about the methodical guidelines from the existing curricula? Why are not implemented in schools?
 - they are not correlated with the existing textbooks (specially in high schools, where abstract algebra, mathematical analysis are taught) and with the time frame provided by the national curricula.
 3. What problems are facing teachers in their day-to-day practice?
 - the classes are highly inhomogeneous, most of the teachers have 3-4 low achieving students, 1-2 high achieving students and 5-7 uninterested students in their classrooms; moreover there are huge differences between adjacent age-groups, so the IBL and WoW contexts need to be changed/updated frequently.
 4. What do you think, how can you help teachers in implementing more IBL and more WoW activities?
 - Answers: we can advertise “best practices”; simplify administrative issues in organizing out of school events;
 5. What recommendations can you formulate to national level policy makers in order to stimulate teachers in experimenting new teaching methods?
 - Answers: give teachers more freedom, more autonomy and less administrative work; a less centralized curricula;
 6. What do you think teachers need from policy makers in order to increase the quality, the relevance of their teaching?
 - Answers: more support on financial issues, more autonomy in professional issues, a wider consultation before changing methodologies, more flexibility in the system, where the responsibility of each person can be clearly outlined.

3.3 Recommendations

The following recommendations were formulated on small events:

1. Give more autonomy to school directors in order to solve local problems, in employing teachers, in setting the standards of the school both for children and for teachers, in assessing teachers and pay them based on this assessment.
2. Give a real financial support which allows the financial support of students' activities (not only the salaries of the teachers and the bills for energy).
3. Reduce the bureaucracy, the number of duties for teachers. In small schools each teacher is involved in several committees (required by the law or by some methodologies).

4. Decentralize the curriculum; the curriculum is made for an average kid which do not exists, so it does not fit for any real kid.
5. Separate the initial training of scientists and teachers.

During the NPW the following main problems were identified and the recommendations were not but a general one which suggests to work on this issues in order to move toward some solutions. The general opinion was that teachers, school directors, inspectors do not feel neither their professional autonomy, nor the endeavour of higher level policy makers towards solving these issues:

1. Local professionals do not have a relevant space to manifest neither as individuals nor as networks or professional associations, there is no real debate on education before implementing changes.
2. From the viewpoint of the system all teachers are equal, there is no distinction among teachers based on the quality of their work and no reward for those who work hard
3. The Romanian educational system seems to have a schizophrenic behaviour: it is highly centralized in terms of employing the teachers (the work contract is signed by the director of the school, but he is not making the decision about employing a teacher or not), in terms of curricula (classes having the same profile have the same curricula all over the country), of type of classes (for a theoretical school there are only a few options regarding the profile of a class), with a lots of demands both for teachers, and local stakeholders and on the same time without creating the possibilities, the mechanisms that can help these categories to respond to these demands.
4. The rate of changes inside the system is too big together with the average age of teachers and this increased rate lead to a high resistance on teachers side
5. Inside the system the assessment of teachers' work is not correlated with the quality of the teaching process (it is aggregated from some administrative achievements, results of students on different contests, it is measured more quantitatively than qualitatively and the decision is not made at the level of school, but it is at the level of counties at the inspector's office).

5. SUMMARY AND CONCLUSION

The discussions were very fruitful; the mixed working mode seemed to be effective in several aspects: each participant understood better the needs and possibilities of the others.

Moreover in some schools there are concrete results in the changing of attitude of directors (e.g. 2 participants in the PD reported that they obtained substantial

financial support for implementing activities in their school, they had the opportunity to buy even didactical materials). These are signs that not all the work was unnecessary. So as a major and immediate outcome we can note that in most of the schools where teachers are attending the Mascil PD courses and the school director attended our (small or large) events, the school management became more supportive or at least teachers' perception about their support has been changed.

On the other hand there were opinion, especially from higher levels, that the widespread implementation is too costly and there is no evidence of effectiveness. A usual school do not have the same possibilities as the projects (like Mascil or like Primas), so even if they have more freedom in choosing or producing their own teaching materials, their situation would not change because these solutions are too expensive even if think only about local adaptations.

The lack of initial teacher training also appeared during the discussions. Currently teachers for general and secondary education (from 5th grade to 12th grade) are trained as scientists (and only in one subject, due to the Bologna system) with a minimum of pedagogical and didactical knowledge (30 credits earned in addition to their bachelor diploma). On the other side the didactics of a subject (maths or science) is not recognized as a separated scientific field (no one can earn a degree in mathematics education, only in mathematics). For this reason the scientific community specialized in teaching different subjects is under a critical mass in Romania. Hence the main problems that came out during the discussions are

1. the lack of initial and continuous teacher training
2. the reduced number of professionals specialized in didactics
3. the non-existence of real possibilities for professional groups in education to influence policy making by non-political instruments

These problems can't be solved without a major political will and a political stability in the education, but for the moment there are not many signs that this will or stability exists.

As a concluding remark we can summarize that on the level we targeted, the NPW and all the small events were successful, this will contribute to the sustainability of the local initiatives. The teachers who participated in the Mascil PD already started to implement ideas, activities, materials from different IBL projects, moreover they started to transform traditional materials to IBL materials and to connect IBL with WoW and having a local support from their school directors, inspectors, they can continue even after the project ends. This will not mean a widespread use of IBL in the country, but there are signs that the seeds planted are growing, the local networks are growing, the participants of PD are acting as non-formal multipliers in their own communities. If the policy will become more stable at higher level and the phrases from the law of education which states that "In Romania the education is a national priority" will gain some sense in terms of initial teacher education, in supporting teachers in their work, then they will act in the benefit of their students by applying more IBL, making more connections to WoW and making schools more attractive.

Appendix 1.

List of participants NPW (linked to Grigore Moisil contest, 27th of March, 2015)

No.	Name	Institution
1	Grigorescu Daniel	Inspector, Ministry of Education
2	Dumitriu-Lupan Nusa	Inspector, Ministry of Education
5	Ciurea Stelian	Lucian Blaga University, Sibiu
7	NAN GABRIELA	Inspector, BIHOR county
8	ZSIGO TAMAS	Inspector, BIHOR county
9	COSIC DOREL	Inspector, BISTRITA-NĂSĂUD county
10	GĂLĂȚAN SUSANA	Inspector, BISTRITA-NĂSĂUD county
11	MAIORESCU GHEORGHE	Inspector, MARAMUREȘ county
12	MĂRIEȘ IULIANA	Inspector, MARAMUREȘ county
13	OPRIȘ ADONIA AUGUSTINA	Inspector, SĂLAJ county
14	PUȘCAȘ FLORICA	Inspector, SĂLAJ county
15	MUNTEAN VALERICA DOINA	Inspector, SATU-MARE county
16	CZIPROK CLAUDIA DANIELA	Inspector, SATU-MARE county
17	COJOCNEAN MIHAELA	Inspector, MUREȘ county
18	Andru Cristian	Inspector, BIHOR county
19	GULER ANGELA	ȘCOALA GIMNAZIALĂ „DIMITRIE CANTEMIR” ORADEA
20	CIOARĂ CODRUȚA	LICEUL "DON ORIONE" ORADEA
21	NICULA CRISTIAN	COLEGIUL NAȚIONAL "PETRU RAREȘ" BECLEAN
22	MUSCAN CORNEL	LICEUL TEHNOLOGIC FORESTIER BISTRITA
23	FĂRCAȘ NATALIA	COLEGIUL NAȚIONAL "VASILE LUCACIU" BAIA MARE
24	ROȘCA OVIDIU	COLEGIUL NAȚIONAL "DRAGOȘ VODĂ" SIGHETU MARMAȚIEI
25	ILONȚA ANDREI	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
26	REVNIC GHEORGHE	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
27	DUMITRU LORENA	ȘCOALA GIMNAZIALĂ MICULA
28	MUNTEANU ANA MARIA	ȘCOALA GIMNAZIALĂ "GEORGE COȘBUC" MEDIEȘU AURIT
29	BLAGA CRISTINEL	COLEGIUL NAȚIONAL UNIREA TG-MUREȘ
30	MUSTAȚĂ GELU	COLEGIUL NAȚIONAL "MIRCEA ELIADE" SIGHIȘOARA
31	COZAC EMIL	ȘCOALA GIMNAZIALĂ "POROLISSUM" ZALĂU
32	FĂRCAȘ NICOLAE	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
33	GORNOAVĂ VALERIU	LICEUL CU PROGRAM SPORTIV "AVRAM IANCU" ZALĂU

34	H Aiduc Sorina	COLEGIUL NAȚIONAL "SIMION BĂRNUȚIU" ȘIMLEU SILVANIEI
35	Jako Daniela	ȘCOALA GIMNAZIALĂ "GHEORGHE LAZĂR" ZALĂU
36	Lucaciu Simona	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
37	Morar Florin	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
38	Știrb Ramona	LICEUL DE ARTĂ "IOAN SIMA" ZALĂU
39	Vlaicu Cristina	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
40	Zay Eva	COLEGIUL NAȚIONAL "SILVANIA" ZALĂU
41	Blaga Alexandru	COLEGIUL NAȚIONAL "MIHAI EMINESCU"
42	Braica Petru	ȘCOALA GIMNAZIALĂ „GRIGORE MOISIL”
43	Fărcaș Mircea	COLEGIUL NAȚIONAL "MIHAI EMINESCU"
44	Marciuc Daly	COLEGIUL NAȚIONAL "MIHAI EMINESCU"
45	Pop Ovidiu	COLEGIUL NAȚIONAL "MIHAI EMINESCU"
46	Pop Rodica	COLEGIUL NAȚIONAL "DOAMNA STANCA"
47	Rebic Camelia	ȘCOALA GIMNAZIALĂ „LUCIAN BLAGA”
48	Vandici Florian	ȘCOALA GIMNAZIALĂ “BĂLCESCU-PETOFI” SATU MARE
49	Șandor Nicoleta Lenuța	COLEGIUL NAȚIONAL MIHAI EMINESCU
50	Tarcău Cristina Ramona	COLEGIUL NAȚIONAL IOAN SLAVICI
51	Comșa Maria	COLEGIUL NAȚIONAL UNIREA TG-MUREȘ
52	Gînta Florica	ȘCOALA GIMNAZIALĂ "LIVIU REBREANU" TG-MUREȘ
53	Gînta Vasile	ȘCOALA GIMNAZIALĂ "LIVIU REBREANU" TG-MUREȘ
54	Mărginean Manuela	COLEGIUL NAȚIONAL UNIREA TÎRGU MUREȘ
55	Oprică Natalia	COLEGIUL NAȚIONAL "AL. PAPIU ILARIAN" TG-MUREȘ
56	Pop Carmen	COLEGIUL NAȚIONAL "AL. PAPIU ILARIAN" TG-MUREȘ
57	Racoți Mihaela Silvana	COLEGIUL NAȚIONAL ALEXANDRU PAPIU ILARIAN TÎRGU-MUREȘ
58	Stoica Angela	ȘCOALA GIMNAZIALĂ "DACIA" TG-MUREȘ
59	Șerban Ștefan	LICEUL TEHNOLOGHIC "PETRU MAIOR" REGHIN
60	Todoran Nicoleta	ȘCOALA GIMNAZIALĂ "DACIA" TG-MUREȘ
61	Bojor Florin	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAI MARE

62	BOROICA GHEORGHE	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAIA MARE
63	BRETAN ANDREI	COLEGIUL NAȚIONAL "VASILE LUCACIU" BAIA MARE
64	CHINDRIȘ LIVIU ION	LICEUL TEORETIC "PETRU RAREȘ" TÂRGU LĂPUȘ
65	COVACIU TRAIAN	COLEGIUL NAȚIONAL "VASILE LUCACIU" BAIA MARE
66	GIURGI VASILE	COLEGIUL NAȚIONAL "DRAGOȘ VODĂ" SIGHETU MARMAȚIEI
67	HEUBERGER CRISTIAN	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAIA MARE
68	HEUBERGER DANA	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAIA MARE
69	MOLDOVAN RODICA	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAIA MARE
70	MUȘUROIA NICOLAE	COLEGIUL NAȚIONAL "GHEORGHE ȘINCAI" BAIA MARE
71	BÎZ MARIA FELICIA	COLEGIUL TEHNIC INFOEL BISTRIȚA
72	GĂLĂȚAN CONSTANTIN	COLEGIUL NAȚIONAL "LIVIU REBREANU" BISTRIȚA
73	BOSANCU ADRIAN	ȘCOALA GIMNAZIALĂ "ARTEMIU PUBLIU ALEXI" ȘÎNGEORZ-BĂI
74	CHICIUDEAN NASTASIA	COLEGIUL NAȚIONAL "LIVIU REBREANU" BISTRIȚA
75	COMAN RODICA	COLEGIUL NAȚIONAL "LIVIU REBREANU" BISTRIȚA
76	IVĂNESCU PETRU	COLEGIUL NAȚIONAL "LIVIU REBREANU" BISTRIȚA
77	MITITEAN ANCUȚA	ȘCOALA GIMNAZIALĂ "LUCIAN BLAGA" BISTRIȚA
78	SANDA NICOLAE	COLEGIUL NAȚIONAL "LIVIU REBREANU" BISTRIȚA
79	SAS MARIA	LICEUL SANITAR BISTRITA
80	SOLOVĂSTRU VASILE	ȘCOALA GIMNAZIALĂ "MIHAI EMINESCU" NĂSĂUD
81	BOLEA CRISTINA	COLEGIUL NAȚIONAL "MIHAI EMINESCU" ORADEA
82	CHIȘIU GABRIELA	LICEUL TEOLOGIC PENTECOSTAL "BETEL" ORADEA
83	CICORTAȘ MARIUS	LICEUL TEOLOGIC BAPTIST "EMANUEL" ORADEA
84	LUNG IOAN	COLEGIUL NAȚIONAL "TEODOR NEȘ" SALONTA
85	NICOARĂ CORINA	COLEGIUL NAȚIONAL "EMANUIL GOJDU" ORADEA
86	NICOARĂ FLORIN	COLEGIUL NAȚIONAL "EMANUIL GOJDU" ORADEA
87	NIȚĂ M. ADRIAN	COLEGIUL NAȚIONAL "EMANUIL GOJDU" ORADEA
88	PETRUȚA GELU	COLEGIUL NAȚIONAL "EMANUIL GOJDU" ORADEA
89	SADOVEANU VIOREL	COLEGIUL NAȚIONAL "EMANUIL GOJDU" ORADEA
90	URSAN RODICA	COLEGIUL NATIONAL OCTAVIAN GOGA MARGHITA
91	ANDREA ADRIAN VASILE	COLEGIUL NATIONAL "EMIL RACOVITA" CLUJ-NAPOCA

92	BALICA PAULA-IOANA	SCOALA GIMNAZIALA "ION AGARBICEANU" CLUJ-NAPOCA
93	BUJU AURA MARINELA	LICEUL TEORETIC "PETRU MAIOR" GHERLA
94	COPACIU EMILIA	COLEGIUL TEHNIC "ANA ASLAN" CLUJ-NAPOCA
95	Czondi János	LICEUL TEORETIC "BRASSAI SAMUEL" CLUJ-NAPOCA
96	Coroian Mihaela	SCOALA GIMNAZIALA AL. VAIDA VOIEVOD CLUJ-NAPOCA
97	Gorcea Violin	LICEUL TEORETIC "AVRAM IANCU" CLUJ-NAPOCA
98	IELCEAN RADU	LICEUL TEORETIC "ANA IPATESCU" GHERLA
99	Ludusan Ioana	LICEUL TEORETIC "GHEORGHE SINCAI" CLUJ-NAPOCA
100	Mateescu Dumitru	COLEGIUL TEHNIC TURDA
101	MORAR DANA-MARIA	LICEUL TEORETIC "LUCIAN BLAGA" CLUJ-NAPOCA
102	MUREȘAN MIHAIELA CORINA	COLEGIUL ECONOMIC "IULIAN POP" CLUJ-NAPOCA
103	Pop Simona Maria	COLEGIUL TEHNIC DE COMUNICATII "AUGUSTIN MAIOR" CLUJ-NAPOCA
104	Rokaly Réka	LICEUL TEORETIC "APACZAI CSERE JANOS" CLUJ-NAPOCA
105	Suciu Otilia	LICEUL TEORETIC "AVRAM IANCU" CLUJ-NAPOCA
106	TARTA GRIGORE	LICEUL TEORETIC "ANA IPATESCU" GHERLA
107	TIVADAR LIVIU VASILE	LICEUL TEORETIC "LUCIAN BLAGA" CLUJ-NAPOCA
108	Vincze Agnes	LICEUL TEORETIC "BATHORY ISTVAN" CLUJ-NAPOCA
109	Sandea Claudia-Călina	COLEGIUL NATIONAL PEDAGOGIC "GHEORGHE LAZAR" CLUJ-NAPOCA
110	Szilágyi Judit	LICEUL TEORETIC "BATHORY ISTVAN" CLUJ-NAPOCA
111	MICLEA ADRIAN	LICEUL TEORETIC "EUGEN PORA" CLUJ-NAPOCA
112	BALAN GABRIELA	LICEUL DE INFORMATICA "TIBERIU POPOVICIU" CLUJ-NAPOCA
113	COMAN MARIANA	LICEUL DE INFORMATICA "TIBERIU POPOVICIU" CLUJ-NAPOCA
114	DANA VAIDA	LICEUL TEORETIC "AVRAM IANCU" CLUJ-NAPOCA

Appendix 2.

List of small events

1. Liviu Rebreanu School, Miercurea Ciuc, 28.11.2014 – 6 participants
2. General School, Capîlnita, 24.02.2015 – 24 participants
3. Valyi Gyula Association, Targu-Mures, 25.05.2015 -6 participants
4. Nagy Istvan Art School, Miercurea Ciuc, 13.04.2015 – 5 participants
5. Marton Aron Highschool, Miercurea Ciuc, 06.06.2015 – 18 participants
6. Tamasi Aron Highschool, Odorheiu Secuiesc, 13.06.2015 – 7 participants

1.9 National Policy Paper : the Czech Republic

Martin Bilek

1. INTRODUCTION

1.1 Overview of current situation of education system in the Czech Republic

In the Czech Republic a reform of the education system is influencing the application of new approaches in last years. The changes relate to wider policy perspectives (macro-level), school level (meso-level) and classroom level (micro-level), and are evident in the following lines. In relation to wider policy perspectives, new curricular documents for all levels of school system have a new structure, it means the structure of educational areas instead of teaching subjects. For the Mascil project related orientation following areas are important: “Man and world of work” and “Mathematics and its Application”. In curricular documents the call for inquiry-based methods has appeared, but only generally mentioned for the time being. Indeed, inquiry based teaching and learning approaches are prioritized in policy making national documents on general level only, without concrete explanation and comments on examples and expected competences. Consequently, the national curriculum prioritizes inquiry based teaching and learning approaches, in general and in specific, in Science and Mathematics subjects, in the primary, general secondary and vocational education, but unfortunately, rather on general level, without concrete explanation and comments in examples and expected competences (as in the national curriculum). It is valid for teacher training and teacher development, too. The considered larger space for IBL and WoW implementation in Science and Mathematics education should be provided within the currently-prepared system of the teacher career structure.

1.2 Summary of national policy paper

National policy paper describes planning, realisation and evaluation of meeting attended by a wide group of Czech and Slovak policy-makers. The topic focused on opinions from the implementation of IBL and World of Work applied in Mathematics and Science education with main focus to teacher education and teacher professional development in the Czech Republic. In our case the group of policy-makers consists from representatives of academic sphere which relates to teacher education. It means governments of faculties of education from the Czech Republic and from the Slovak Republic and a few representatives of important institutions as Ministry of Education, Accreditation Commission, professional associations, experts from pedagogical sciences and teacher development etc. Results of discussions, presented opinions and recommendations seem to be very productive and in general, it seems that the realisation of current educational reform works as a big challenge for application of the IBL and WoW approach to school practice.

2. APPROACH AND METHODOLOGY

2.1 Rationale for selection of policy makers

Long-time Czech Mascil team experience was exploited for the National Policy Workshop in the field of pre-service teacher education on all levels of the school system, i.e. from the pre-primary, primary, lower and upper secondary level to the field of vocational school teacher education. Most of the Czech Mascil team members work at the Faculty of Science, dealing with in-service teacher preparation on the upper secondary schools, but they are closely co-operating with the Faculty of Education, thus having impact on all the above mentioned levels. This fact was strongly reflected in the preparation of the workshop.

The workshop was held within a regular meeting of top managements (Association of deans) of faculties of education from the Czech Republic and the Slovak Republic organized in April 2015 in Hradec Kralove (home town of the Czech Mascil team). Deputies from all addressed faculties were present at the meeting, i.e. 37 academics from nine faculties in the Czech Republic and 16 academics from six faculties from the Slovak Republic. Moreover, following experts were present: from the Czech Ministry of Education, Youth and Sports; from the Czech Government Accreditation Commission, section for Pedagogy, Psychology and Kinantropology, and from the section for Subject Didactics, a deputy of Association of grammar schools directors who is responsible for the proposal of the teacher career development structure, and other experts from the field of education. Within this meeting organisers from the Faculty of Education, University of Hradec Kralove, reserved a two-hour section for the workshop focusing on the presentation of the Mascil project and mainly on the discussion on problems related to IBL and WoW as new approaches to education, which should be particularly used in the pre-service and in-service teacher education.

2.2 Rationale for selection of specific issues for discussion

The workshop mainly aimed at starting the discussion on important topics relating to the implementation of inquiry-based instruction and on the results of the process of IBL implementation in Maths and Science in university study programmes for teachers of various subjects/fields and levels of education, on the support of curricular documents relating to the running reform of education, on readiness/qualification and practice of just-graduated teachers for IBL implementation, on the interest in IBL with teachers in practice etc.

2.2 Implementation of national policy workshops

A topic for discussions within the workshop was the current state of curricular documents and materials and their focus on IBL and WoW. In the Czech Republic two-level curricular system is currently applied. It consists of so called Framework Educational Programme (Rámcový vzdělávací program, RVP) for a given level which is used for setting authentic School Educational Programme (Školní vzdělávací program, ŠVP). In practice the strategy was set which does not prescribes compulsory subjects but Educational areas on the level of Framework educational programme. Within the Educational areas schools can either use the traditional

subjects, or create new subjects, blocks or other organizational forms of instruction. Reflecting the focus of the Mascil project, following areas were set: “Maths and its applications” which also includes the so called educational field Maths; and the educational area “Man and the Nature” which embraces educational fields Physics, Chemistry, Biology and Geography. Moreover, other educational areas closely relate - “Information and communication technology”, “Man and the world of work”, “Man and the Health” and the cross-curricular topic “Environmental education”. Another important point of the discussion was the current problem of compatibility of the school reform and teacher preparation; unfortunately, the new curricular approach has not been emphasized to a large extent. Traditionally, the Czech education system supports two-subject preparation, in numerous cases freely combining Science and Humanities.

Above all, questions on approaches and limits to the implementation of IBL and WoW in the current school practice were also discussed, including the administered survey (see 3.2).

2.3 Problems/issues arisen during the implementation

The workshop was held in a friendly and helpful atmosphere. A problem could have been the fact that in the Czech Republic the pre-service and in-service teacher education is not provided solely by faculties of education but teachers for lower and upper secondary school can also study at faculties of arts, science, maths-physics, technical faculties etc.

Their approaches may sometimes differ from those of faculties of education, particularly in emphasizing the subject and underestimating the didactic preparation etc. From this reason conclusions from the workshop should be relativized, when taking other interested educational institutions (including those focusing on further education) into account.

3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

Workshop programme:

- Introduction and Welcome of participants
- Presentation of the Mascil project and its implications for the Czech education system,
- Discussion on the implementation of IBL and WoW in-curricular documents in relation to the education reform,
- Group work on the survey on IBL and WoW,
- Conclusion.

3.2 Themes and issues discussed

Within the discussion on implementation of IBL and WoW in curricular documents and pedagogical practice following topics were mentioned:

- unclear terminology and methodology, frequent misconception of IBL and project or problem instruction,
- incorrect understanding of the core of inquiry based instruction within the teaching staff (it is not a new method!),
- negative (rejecting) and distrustful approach to IBL from the reason of uncertain learning results,
- specifics of the IBL implementation in Maths and Science compared to other subjects,
- positives of the IBL implementation versus risks (no-n reached outcomes in Science subjects – the question is a radical reappraisal of expected educational outcomes in concrete subjects, key competences),
- material demandingness of the preparation and application of IBL versus limited equipment of schools, the necessity of support from project sources.

Further on, participants worked on the survey which was administered to deputies of institutions participating in the workshop and contained following theses; respondents expressed their agreement or disagreements, or difficult to decide, and provided comments. They evaluated positives and negatives of IBL and WoW in pedagogical practice. The survey contained following items:

- Current education concept in my country pays emphasis on Inquiry Based Teaching and Learning.
- Current education concept in my country pays emphasis on connecting the instruction with the World of Work.
- List (from your point of view) three most important positives of IBL and its relation to the WoW.
- List (from your point of view) three most important negatives of IBL and its relation to the WoW.

4. RECOMMENDATIONS

From the analysis of discussions and answers to the survey, following recommendations can be provided:

1. To open the discussion on forming curricular materials which will more focus on educational processes than on concrete learning contents of subjects.
2. To develop and financially support the system of further education of teachers in the field of IBL and WoW.
3. To ensure stronger and concrete support for implementation of IBL and WoW in curricular documents, including renovation of textbooks and other study materials.
4. To exploit the two-level curriculum for creating non-traditional school subjects with emphasis on IBL and WoW, both in general and vocational education.
5. To innovate curricula of teacher study programmes towards higher level of application of IBL and WoW.
6. To ensure the exchange of experience on the international level and various school levels – “eTwinning”.

7. Possible initiation of follow-up workshops on given topics (IBL, WoW) at partner institutions and Maths and Science forums (e.g. Association of Czech Mathematicians and Physicians, Czech Chemical Society etc.).

5. SUMMARY AND CONCLUSION

National Policy Workshop initiated by the Mascil project in the Czech environment brought interesting feedback from the participants– policy-makers in the education space. Substantial conclusions from the discussions and particularly from the analysis of the survey can be summarized as follows:

- I. Supportive arguments for positive evaluation of the current state in the implementation of IBL and WoW in the Czech Republic and Slovak Republic:
 - there exist projects which are currently conducted on primary and lower and upper secondary schools,
 - it is a topical item attracting special attention in recent years (project PRIMAS),
 - the application strongly relates to the personality and professional abilities of the teacher, ,
 - in Maths and Science the state is better than in other subjects.
- II. Supportive arguments for negative evaluation of the current state in the implementation of IBL and WoW in the Czech Republic and Slovak Republic:
 - the state more depends on the school than on teachers,
 - at lower secondary schools subjects are more isolated (in my opinion), they are not connected, mainly in Science subjects so that the IBL could be effectively implemented,
 - IBL in the Czech Republic is a marginal approach only,
 - Educational areas from the background (they are not highlighted) within the Mascil project, they are often taught by non-graduated teachers (or graduated in other subjects),
 - IBL ideas are presented, the reality is different,
 - The education system mentions the connections but relevant evidence for practice is missing.
- III. The strongest positives of IBL and its relation to the WoW:
 - positive impact of the personality of the learner, learning content and methods of work,
 - activation of the learner and their competence development,
 - development of logical and autonomous thinking,
 - the creativity support,
 - development of the ability to be well informed about the WoW,
 - development of self-reliance (self-activity) and critical thinking,
 - a positive experience from own independent discovery,
 - keeping up with the times.
- IV. The strongest negatives of IBL and its relation to the WoW:
 - demandingness of IBL on organization, time and financial sources,
 - non-preparedness of teachers, bad teacher makes more damage when applying the IBL approach than in the traditional teaching,
 - insufficiently worked out methodology,

- WoW – do we know now what the state will be after 30 - 50 years?
- fragmentation of topics into isolated areas – general overview is not provided,
- if the strong knowledge basis is missing, the IBL cannot be applied,
- elements of IBL and WoW are not included into the school evaluation criteria,
- a lack of awareness of IBL and WoW and their connection to the real life.

Reflecting all the above mentioned, we are aware a large extent of work is still in front of (all of) us. It is high time we started with the process of IBL and WoW implementation into the Maths and Science education on all levels of schools in the Czech Republic, as these approaches provide our system of education with connection the real world to the learners, which we expect will enable them to succeed on the labour market in the future.

6. Appendix – photo-documentation



Fig 1 Opening speech by vice-dean of Faculty of Education UHK



Fig. 2 Participants of National Policy Workshop



Fig. 3 Survey in groups



Fig. 4 Discussion on Mascil materials



Fig. 5 Discussion on Mascil materials

1.10 National Policy Paper : Germany

Gultekin Cakmaki

1. INTRODUCTION

1.1 Overview of work package 2

In the process of analysing educational systems and the policy contexts in Turkey the issue of lack of policy reports in Turkey has been emerged. Accordingly, partly as a result of policy workshops and mascil project, a small research group was established to write a policy report on STEM education in Turkey.

As a result of policy workshop, teacher workshops and policy reports, the visibility of our research team has increased in local media coverage and other social media coverage.

Mascil Turkey Team presented an oral presentation at IOSTE Eurasia Regional Symposium & Brokerage Event Horizon 2020. <http://www.ioste2015.org/>. In total there were more than 150 participants from 24 countries.

1.2 Summary of national policy paper

The advisor of Minister of National Education and the director of Altindag Ministry of National Education have participated in mascil teacher workshops and gave a certificate to pre-service and in-service teacher who have completed 26 hours of mascil workshops over around five months. The participants implemented mascil activities in their classrooms and most of them wrote a case study based on their classroom practices.

2. APPROACH AND METHODOLOGY

First MASCIL (Mathematics and Science for Life) and INSTEM (Inquiry for Science, Technology, Engineering and Mathematics Education) project national workshop have been held together at Hacettepe University, Ankara on October 22, 2013. Afterwards, there has been several individual meeting with policy makers. For instance, during a workshop on STEM education in Istanbul, during at IOSTE 2015 Eurasian Regional Conference, a visit to advisor of Minister of National Education and during INSTEM conference in Freiburg.

2.1 Rationale for selection of policy makers

Policy makers from different sectors and fields have been invited to the workshop. Details of participants have been provided.

1	Abdulkadir Ozbek	PDA Consultancy
2	Ahmet Ilhan Sen	FP7 MASCIL, Hacettepe University
3	Ali Yilmaz	Department of teacher education and development, Turkish Ministry of National Education & MASCIL EAB member
4	Alipasa Ayas	Bilkent University & MASCIL national advisory board member
5	Buket Akkoyunlu	FP7 SAILS, Hacettepe University

6	Celal Bayrak	Dean of the Faculty of Education, Hacettepe University
7	Gamze Yuksel	Science Teacher
8	Gultekin Cakmakci	MASCIL & INSTEM, Hacettepe University
9	Ipek Ince Sungur	Teacher
10	Jale Cakiroglu	Middle East Technical University
11	Metin Bagdat	Director of Foreign Relations, Small and Medium Enterprises Development Organization & MASCIL national advisory board member
12	Mustafa Ali Turker	SEBIT, an FP6 project coordinator
13	Omer Faruk Ozdemir	Middle East Technical University
14	Sadi Tureli	Vice President of SEBIT
15	Savas Gungoren	Teacher
16	Sinan Erten	Hacettepe University
17	Yakup Aslan	Physics Teacher

Following key actors have been visited individually.

18	Mustafa Hilmi Çolakoğlu	Advisor of Minister of National Education
19	Emin Karip	Ministry of National Education
20	Kayhan Karlı	Innovative Learning Center
21	Ahmet Eti	CEO, SEBIT

3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

National Advisory Board meeting for MASCIL (Mathematics and Science for Life) and INSTEM (Inquiry for Science, Technology, Engineering and Mathematics Education) project national workshop have been held together at Hacettepe University, Ankara on October 22, 2013.



3.2 Themes and issues discussed

Discussion points

- Although, the agenda for the meeting was set and the moderator tried to facilitate the discussion participants of the meeting had a tendency to talk and express their views on recent changes in science and mathematics education. In Turkey, the science and mathematics curricula were changed very recently in 2013. The curricula were developed by the Scientific and Technological Research Council of Turkey (TUBITAK) and Ministry of Education. They have just been implemented in Grade-5 and Grade-9. The most important features of the new curricula are that they aim to promote the use of inquiry based education and use of alternative assessment strategies. IBST is included in the curriculum framework of science and mathematics education to some extent. What this means in practice is not explicitly specified in the curricula. The curricula use alternative assessment tools, and also formative assessment along with other kinds of assessments. Nevertheless, as expressed by the participants, teachers are under pressure because parents ask teachers to use other kinds of assessment tools that are more aligned with the exams the student will take. Therefore teachers prefer to use summative assessment rather than other assessment tools. One of the shortcomings of the science and mathematics curricula is not having a teacher's guidebook. Teachers have not given enough resources how to implement the activities. Teachers are left alone or for some they give freedom to use their creativity while teaching science and mathematics.
- Another issue discussed by the participants was not having long-term cycle policies. One of the challenges that Turkey faces with is the unsustainable short-term cycle of policies in education. Over little more than a decade, the minister of education changed five times and each person in that role had different priorities, agendas and different kinds of science and mathematics education. Several participants claimed that there is not a strong coordination and collaboration between Ministry of Education and Higher Education Council of Turkey.
- Turkish Ministry of National Education, Department of teacher education and development, is mainly responsible for TPD programs. Inquiry or elements of inquiry are mentioned, to different degrees, in the primary and secondary mathematics and science curricula (physics, chemistry, and biology) in Turkey; however, implementing these ideas into practice has been challenging for teachers. Mainly because of ineffective teacher professional development (TPD) programmes and requirement of assessment. TPD is seen not successful in Turkey. In Turkey, TPD programs are too short to make an impact; there are no long-term training programs. Moreover, most teachers do not value these programs enough to learn from them. Participant suggested that more effective TPD programs are needed especially for science and math teachers. It is stated by many researchers that there is a need to specify qualifications teachers should have and to train teachers based on these

qualifications. However, the current models for TPD in Turkey are based on a deficit model: Teachers are not good enough so we have to make them better. TPD may also be based more on the assumption that teachers are professionals who should be offered possibilities to improve. Due to short periods of training without any reflection afterwards, no evidence is reported on the effectiveness of these training. However, with a series of TPD sessions over a time period would be more effective. Participants teachers expressed that although the curriculum has changed, they haven't had any TPD program on the new changes or on IBSL. Some good examples of TPD were expressed by the participants were as follows: "Öğretmen Mesleki Gelişim Eğitimi Projesi 2009 (ÖMGEP)" <http://bit.ly/L3QyIt> "Öğretmen Akademisi Vakfı Öğretmen Çalıştayları" <http://www.orav.org.tr>

- Participant teachers who joined other FP7 projects expressed that short term Professional Development programs were not so effective. They suggested continuous professional development instead.
- More WoW (World of Work) like activities can be used in science and maths teaching and assessment tools should be aligned with these activities. Open ended context-based questions can be used for assessment.
- A kind of database or industrial and school network can be established. This database can be used by teachers while they need to collaborate with an appropriate WoW. Besides, a database can be set to help teachers, researchers and policy makers to learn and make use of the outcomes of the national and EU projects.
- In Turkey, tablet PCs have been given to students and in coming years all students will get one. <http://fatihprojesi.meb.gov.tr/tr/index.php> However, teachers have not trained enough how to use them in teaching and lack of software and educational programs are one of the most challenges.
- Companies that develop and support teachers how to use IBL materials should be supported with the coordination of Ministry of Education and Higher Education Council.
- To encourage teachers to use IBSL activities, sample IBL activities can be translated into mother language and those can be shared with teachers. Participating and presenting at teacher conferences would help teachers to implement this kind of activities in their teaching.

3.3 Recommendations

- Production of national white papers. For instance a report on STEM education in Turkey has been written. The paper is available at:

<http://fs.hacettepe.edu.tr/hstem/dosyalar/STEMRaporu.pdf>

- Increasing the impact of EU and national projects: There are not many EU funded IBSE project in Turkey. Just recently the number is increasing and these project effect teachers' perceptions of TPD training and they ask the Ministry of Education to have these kinds of TPD programs in their agenda.
- IBSE project recommendations are mainly linked into national policy developments. In the new science and mathematics curricula, inquiry or elements of inquiry are mentioned, to different degree. Emphasis has been put on student centeredness, increased student activity, scientific literacy, and science process skills together with inquiry in the new curriculum. That would be seen as an impact of EU funded projects on IBSE.
- National and international projects that aim to promote IBSE offer best practices of TPD, however the numbers of these activities are limited.
- The voices of teachers are partly represented in EU Commission funded IBSE projects. Teachers want to see best practices of IBSE activities and continue support while implementing those at the classroom. In Turkey, the science and mathematics curricula were changed very recently in 2013. The curricula use alternative assessment tools, and also formative assessment along with other kinds of assessments. But the teachers are under pressure because parents ask teachers to use other kinds of assessment tools that are more aligned with the nationwide exams the student will take. Therefore teachers prefer to use summative assessment rather than other assessment tools.
- The Scientific and Technological Research Council of Turkey (TUBITAK) encourages and funding any initiative activities related to entrepreneurship and innovation education and enhancing public understanding of science. IBSE activities are set a basis for reaching such aims.

Pictures



1.11 National Policy Paper : Lithuania

Egle Jasute & Valentina Dagienė

1. INTRODUCTION

1.1 Overview

This report provides a description on how the National policy workshop in Lithuania was organized and implemented. At first, we identified key-persons and policy makers in our country and invited them to a national workshop. To ensure participation in the workshop, we draw on our existing connections to stakeholders. Policy makers are considered people in relevant high level positions related to educational policy at a national and regional level. We and policy makers discussed issues addressed in the Cross-national report and policy paper of Lithuania (D2.2 and D2.3). We used the suggestions of these reports with an aim to identify what research can offer to policy makers. The questions addressed in the national policy workshops were the following:

- What obstacles for the national implementation of these guidelines do you see in national policy?
- How can these obstacles be overcome within the political area?
- What recommendations can you give to educational policy on a national level?
- How can policy and science cooperate to reach their common aim: a widespread implementation of inquiry-based science teaching?
- How can policy on a national /international level be involved?
- How can they support the project endeavour?

The results and insights of this process are documented in this report to motivate policy to support the widespread implementation of inquiry based science teaching (IBST).

1.2 Summary of national policy paper

The main aim of the national policy workshops is to foster cooperation and synergies among research, and practice fields, by producing strategies to support the widespread uptake of inquiry-based science teaching. The participants and programmer of workshop are presented. The mascil relation, and Inquiry-Based Learning (IBL) and World of Work (WoW) implementation in Lithuanian STEM (science, technology, engineering and mathematics) strategy are discussed.

2. APPROACH AND METHODOLOGY

2.1 Rationale for selection of policy makers

Several criteria determined the choice of participant of the workshop:

- STEM group members. The STEM programme implementation is priority in Lithuania. We see connections between STEM and project mascil. The invitation of participants of workshop was focused on national STEM group. The members of STEM group are from industry, universities, schools, Ministry of Education and Science, and Educations Development Centre.
- Mascil NAB members. Mascil NAB group members are from Educations Development Centre, universities and schools.

The main goal of this workshop was to make discussions between researches, teachers, teachers' educators and policy makers in the above mentioned questions/topics. This goal inspired us to invite representatives from the relevant institutions. Therefore, we had wide range of professions for discussions in the workshop.

2.2 Rationale for selection of specific issues for discussion

The expected outcome of the discussion during the national policy workshops revolves around the question: What can be done on national/international levels to motivate policy support the widespread implementation of inquiry-based science teaching?

The Cross-national report (2013) and Policy paper has yielded some more general conclusions and recommendations for policy makers. These are at a more general level and need to be contextualised to serve as a foundation for NPW discussions. These conclusions and recommendations are quoted and discussed in the following paragraphs (Cross-national report, 2013):

- The priorities that are evident in the national policy agendas are in line with wider European policy strategic aims, indicating a conducive context on which national policy practices can build on.
- There is a need for coherence in policy rhetoric between expectations of students' learning and expectations of teachers' training, which seems to be lacking at the moment. The proposed compatibility between policy envisions regarding the teaching of mathematics and sciences as evident in policy documents and policy orientations regarding teacher training, will be a step towards bridging the gap between what is envisioned in theory and has is implemented in practice.

- Inquiry based learning seems to be prioritized more in primary and general secondary than in vocational education. Policy makers should consider the potential of the methodology in vocational contexts, and make more effort in promoting inquiry based learning in vocational contexts.
- In countries with a tradition on implementing activities relating to inquiry based learning, policy orientations seem to move towards more content based curriculum objectives and emphasis on content knowledge; discussions among policy makers in different countries would benefit the re-consideration and the negotiation of major strategic aims in education in each country for further improvement.
- School cultures are resistant to change. Careful and in-depth analysis of different parameters pertaining to school culture will benefit the successful accomplishment of policy envisions in relation to inquiry based methodology to school practice.
- There is a need to value the learning of inquiry process in schools by identifying and including the assessment of these processes in national assessments.
- There is a need to support the development of educational materials and teaching methods to help teachers in enriching their repertoire towards inquiry based learning.
- There seem to be a reluctance to implement inquiry classroom activities not only from the part of teachers but also from parents. For the successful implementation of inquiry based learning teacher professional development should be accompanied with the actual engagement of parents.
- The connections between schooling and the world of work seems to be prioritized at a level of a general rhetoric in some counties without concrete action plans, especially in primary and general secondary education. Policy makers should further consider the potential of such a connection, in the view of enhancing employability.
- The rethinking and redefining of the concept of the “world of work” is the basis or an appropriate preparation of pupils for the career entry. Strengthening the connections and cooperation between general and vocational education would enable the exchange of good practices and expertise.
- There is a need to value the connections between schooling and world of work by identifying and including it in the national curriculum.
- There is a need to support the development of educational materials and teaching methods to help teachers in enriching their repertoire towards making connections between schooling and the world of work.

- Vocational schools should be supported in integrating further work in their school activities (for example visits to workplaces, development of teaching materials, practicum, and visits of experts to schools).
- Well educated teachers are the foundation of any system of formal science, mathematics and technology education. Systems to ensure the professional development of teachers should be a national policy priority, and a coherent national policy orientation of training initiatives should be evident and prioritized.
- Transforming teacher practice should be a long-term project, requiring significant and sustained investment in continuous professional development. Short-term cycles of training initiatives have proven to be unsustainable and of little effect in transforming classroom practice.
- Concrete guidelines or measures on how equity, low-achievement and entrepreneurship issues are to be addressed in science and mathematics education are needed. Important to this respect is the consideration on how specific teaching methodologies (such as inquiry based learning) may be a lever towards the accomplishment of such aims.
- There is a need to support teachers through effective pre-service and in-service teacher training and appropriate materials so as to transform classrooms in a way that equity, low-achievement and entrepreneurship issues are matters of day-to-day practice.

These Cross-national report outcomes directed discussions in the workshop. But it was not possible to discuss all recommendations during such short time. We chose several of them what we think are more relevant for the Lithuanian educational context:

- School cultures are resistant to change. This very wide question was the bases of the discussions. There some important aspects are hidden: the exam oriented education and the culture of choosing methods for class education. What we can to do to change this culture?
- Well educated teachers are the foundation of any system of formal science, mathematics and technology education. This recommendation is closely related with supporting of the development of educational materials and teaching methods to help teachers in enriching their repertoire towards inquiry based learning.
- There is a need to value the connections between schooling and world of work by identifying and including it in the national curriculum.

The STEM is priority in Lithuania now. And this approach is very close to mascil ideology. We see that there is possibility to implement recommendations of the mascil Cross-national report. The discussions of workshop were concentrated on how

to implement IBST into STEM strategy and to solve more concrete problems. For example: how to organize and to involve all Lithuanian teachers of mathematics, science, technologies, computing and other subjects to use IBL? The question is related with teacher professional development and teacher preparations in the universities, and of course it has a financial aspect too. Other question was how to make STEM subjects attractive to students.

2.2 Implementation of national policy workshops

The national policy workshop was organized at the Ministry of Education and Science of Republic of Lithuania on the 20th of January, 2015. Discussions lasted about two hours.

21 key-persons and policy makers were identified in Lithuanian (see Appendix 1). The representatives from the Ministry of Education and Science, the Educations Development Centre, the Centre of National Exams, the high schools and universities took part in the workshop. The vice ministry of the Ministry of Education and Science and the mascil National Advisory Boards participated in this event. We invited persons from fairly wide domains of education: policy makers, teachers' trainers, teachers and members of National STEM group. We see IBL implementation perspectives in relation with STEM implementation in Lithuania.

2.3 Problems/issues arisen during the implementation

The Workshop was quite successful. The main aim of Workshop – to foster synergies between researcher and policy, to negotiate what should be done in order to motivate teachers implement IBL in a WoW context. Other task was to discuss on concrete problems and to reach an agreement in relation to implementation in schools mathematics and science for life.

The discussions helped to clarify problems of IBL implementation in school education. Majority of participants have pointed out direct connection between STEM and mascil.

3. DOCUMENTATION OF THE WORKSHOP

3.1 Setting and Context of NPW

The educational process has to involve students into active and deliberate learning; the active learning and teaching methods have to be used in the lessons. Teacher has to motivate students to think independently, to learn active and from experience. Students learn to actively collaborate with others, to have a look at new ideas, things, environments and technologies. The teaching have to stimulate students to ask,

study, seek, test, analyze, solve problems, create. The teachers are encouraged to use active teaching methods.

There two domains which are integrated in all mathematics curricula: problems solving and skill to learn mathematic and to interest in mathematic. Most of science topics can be taught with IBL.

The mathematics skills related with IBL:

- The students understand about management of problematic situations is formed.
- Students learn to evaluate what knowledge and skills they need to solve problem by steps.
- Student achieve experience how to offer several solutions and choose one, how to seek purpose, how to held and test simple hypotheses, how to study and evaluate prior knowledge and skill in the context of new one.
- Student have to want and be prepared to learn mathematic actively and independent; to see the practical use of mathematic knowledge and skills in everyday life; to see mathematics usage in other subjects, professions.
- The teacher forms student's view to mathematics learning as interesting and significant activity; as tool for critical thinking, general problems solving, communicating and collaborating.

The students' skills of science education described in the national curricula convey the priorities of science education related with IBL:

- Students recognize and classify the most important living and non-living natural objects and phenomena, observe consistent patterns, understand and apply basic science concepts, laws and theories, purposefully use characters of sizes and dimensions, solves a simple practical problems in science, apply acquired science knowledge and skills in solving everyday problems;
- Students held questions and hypotheses, plan observation and experiments and safely use laboratory tools and materials, do experiments, summarize data, evaluate their accuracy and reliability, formulate concussions on the findings;
- Students are interested in a variety of organisms, identifies major groups of organisms, understand significant of their adaptation to the environmental, basic life processes, the principles of a healthy life;
- Students explore a variety of materials, recognize them, describe their use and distribution in nature, and classify their properties, notes material variation consistent patterns;
- Students study and analyze physical phenomena of living and non-living natural, develop scientific world view and a responsible attitude to the environment, nature and life;

Students are interested in science and technology in Lithuania and in the world, priorities of science in our country on direction of engineering and technology development, learn about careers that require science knowledge and skills.

To reach success in this changing world, students have to use knowledge of science, mathematics and technology and to apply them to solve personal, social and global problems. The problem solving, inquiry learning, discovering and active students' participation in the process has to become the main power of education. These methods can be implemented in the STEM education.

STEM education is a curriculum based on the idea of educating students in science, technology, engineering and mathematics in an interdisciplinary and applied approach. STEM integrates four disciplines into a cohesive learning paradigm based on real-world applications.

The STEM group was involved in NPW to discuss and find touch points of IBL, WoW and STEM in Lithuania.

3.2 Themes and issues discussed

The programme of NPW included four parts: 1) the presentation of mascil project and IBL, 2) the presentation of real IBL class in Lithuania (video), 3) the teacher presentation of inquiry lesson, 4) the discussion "IBL and WoW in relation with STEM and desirable results" and conclusions.

The discussions were around fairly deep and difficult to solve IBL and WoW educational problems:

- To motivate teachers to use IBL and WoW in classrooms
- To encourage teachers in cooperating with each other (interdisciplinary)
- To foster cooperation and synergies among research and practice

Also the discussions on recommendations of Cross-national report (2013) were fruitful. The most questions and interests focus on four directions

- *School cultures* are resistant to change. There some important aspects are hidden: the exam oriented education and the culture of choosing methods for class education. What we can do to change this culture?
- *Well educated teachers* are the foundation of any system of formal science, mathematics and technology education. This problem is closely related with supporting of the development of educational materials and teaching methods to help teachers in enriching their repertoire towards inquiry based learning.
- *The involved and engaged students* achieve better results. Learning materials and teaching methods are important to attract students. IBL is seen as one of methods which involve students and improves their knowledge and social skills.

- *The dissemination* goal – to inform society about IBL and WoW in STEM subjects. To promote STEM in social level, to inform about STEM integration in formal and informal education. The most number of STEM subject teachers has to be informed about active student oriented methods.

All these discussed issues are directed to students. The main aim is to improve students' learning results by involving them to learn STEM subjects. And this aim could be reached by changing teachers mind to develop teaching styles, enriching education material, and disseminating good practices.

3.3 Recommendations

The recommendations of workshop group were prepared from three perspectives: students, teachers and society.

The students are the most important part of this work. The main goal of education is to seek better students' achievement results. The skills of creativity, inquiry, and enterprise are relevant for today person. For this purpose the recommendation were suggested:

- To prepare recommendations for curricula in collaboration with science and social institutions. To review and improve curricula considering at students skills of creativity, inquiry, activity and enterprise. To start STEM education from preschool and primary school level. To make recommendations and methodologies to implement STEM in these levels of education. To provide modern material for STEM education to preschools, primary, basic and secondary schools.
- To develop network of STEM schools at national level. To prepare modern laboratories for science, engineering, and technology education.
- To support gifted students in STEM context. To promote universities to take part in school education.
- To promote students collaboration in national and international level, the partnership between universities, industry, schools and society, and the initiatives to educate students' creativity, activity and enterprise through development of science research and technology.
- To strengthen informal education. To develop open centres (future classes, mobile laboratories etc.) for students in STEM context. To prepare programs for informal education to reach the harmony between formal and informal education. To support students camps of STEM.

Well educated teachers are the foundation of any system of formal science, mathematics and technology education. The teachers have to engage and involve students. It is challenge for Lithuanian teachers. The appropriate attention has to be given for teachers in STEM context and recommendations were detailed in this case:

- To improve teachers' competencies in context of STEM education. To promote in-service teachers practice and mobility experience. To support preschool and primary school teachers' professional development of STEM education.
- To develop and support portal for STEM subject teachers communication and collaboration to make opportunity to exchange the material, good practice and other.
- To prepare and/or update educational programmes for pre-service teachers oriented to STEM education. To promote STEM students.

The society has to be informed about news in STEM education to attract more students to learn STEM subjects. The dissemination of IBL and WoW in STEM come into notice and some recommendations were proposed:

- To develop interactive and virtual educational areas in informal. science, and cultural institutions. The virtual museums can be created for science and/or interdisciplinary. To use existing museums of science, technology for STEM education. To organize educational events in open centres of institutions of science and studies.
- To inform society about news and actualities of STEM by audio and/or video tools.
- To promote interdisciplinary collaboration in organization of events of STEM context.

All presented recommendations were included into Proposal paper of STEM The paper was prepared by group of policy makers approved by the Minister of Education and Science. Valentina Dagiene and Maryte Skakauskiene were group members and were taken care of IBL implementation trough the STEM project at Lithuanian schools.

5. SUMMARY AND CONCLUSION

Schools that participate to the mascil project are active and enthusiastic. Teachers like to use IBL in their lessons and share their experience with neighbouring schools. We should keep this teacher network, update their knowledge and skills each year. Thus we should try to arrange seminars or workshops at least twice per year. Also, we can use joint events with other partners or institutions. For example, we are planning to have a discussion on the mascil topics

Due to the strategic plan of improving STEM teaching and learning in schools of Lithuania, with active promotion of the Ministry of Education, we should make collaboration with STEM policy makers and established STEM schools.

The NPW lets to reach common suggestions for implementing IBL and WoW in STEM education. The discussions were on more general level. The STEM group accept all recommendations of Cross-national report (2013). The policy makers support the idea to include IBL and WoW in STEM recommendations as a method to involve and engage students to learn STEM subjects.

The participants of workshop agree that the teachers' professional development in usage of IBL and WoW could be one of the items of STEM programme. The active students' oriented methods are suitable for learning STEM subjects.

Appendix 1. List of participants at the national policy makers' workshop

Marytė Skakauskienė, Ministry of Education and Science (NAB)

Daiva Vaišnorienė, Ministry of Education and Science

Audronė Šuminienė, Ministry of Education and Science

Monika Vanagaitė, Vilnius university, student

Svetlana Kauzoniene, vice minister of Education and Science, Ministry of Education and Science

Jūratė Vosylytė-Abromaitienė, Ministry of Education and Science

Dalia Švelnienė, Ministry of Education and Science

Jurgita Nemanienė, Ministry of Education and Science (NAB)

Sandra Balevičienė, National Agency for School Evaluation

Regina Žukienė, Teacher Development centre

Loreta Statauskienė, Teacher Development centre

Alvida Lozdienė, Teacher Development centre (NAB)

Giedrė Čiagienė, Teacher Development centre

Albina Vilimienė, Teacher Development centre

Saulė Vingelienė, National Exam centre

Daina Krilavičienė, Kaunas „Santara“ high school

Loreta Kablytė, Kaunas „Santara“ high school

Linas Butėnas, Vilnius University Faculty of Mathematics and Informatics

Viktoras Dagys, Vilnius University Institution of Mathematics and Informatics

1.12 National Policy Paper : Austria

Suzanne Kapelari

1. Introduction.

“In order to open schools to the world of work, partnerships should be established with industry, vocational schools and providers of informal education. Informal learning institutions include zoos, botanic gardens, museums, science centres ‘young’ university programs for children and teens and outdoor education programs. They can provide meaningful settings for science and mathematics learning and give insight into vocational contexts with hands-on experimentation. There is plenty of evidence illustrating the benefits of the partnership between schools and professionals, such as mathematicians in work places, private companies, scientists or informal learning providers” (MASCIL DoWp9.)

Thus the aim of a national policy workshop is to

“... foster cooperation and synergies among research, and practice fields, by producing strategies to support the widespread uptake of inquiry-based science teaching”. (MASCIL briefing paper on national policy workshops p.2)

The Austrian MASCIL policy workshop took place in a day while the Austrian teacher education system has been facing fundamental changes in how pre and in service teachers will be trained in the future. So far Universities and Pedagogical Colleges have not managed to develop a shared understanding of how our traditional dual teacher education system should be merged into one. Work is still in progress. However this causes many problems in engaging policy makers from different stakeholder groups in activities such as the one planned and implemented in the Austrian MASCIL policy workshop. Against this background it was important to inspire confidence and trust amongst stakeholders and provide a space for discussion and planning in a clearly defined area separated from those which are the reason for current disagreement. Taking this into consideration the MASCIL policy workshop aimed for planning and implementing a completely new joint bachelor or master program to implement MASCIL-science ideas in the field of agriculture and landscape development.

2. Identifying the Austrian target group:

The Austrian MASCIL policy workshop was dedicated to inform participants about the MASCIL idea and to present a possible path for invited institutions to follow. The idea was to implement MASCIL ideas sustainably in the future and design a joint bachelor and master study for teachers and educators being trained in IBL linked to the world of work. As we considered it more effective to focus on a particular field than to spread activities all over various fields of work we decided to develop a bachelor/master program for teachers and educators linking inquiry based teaching and learning with the content specific for agriculture, landscape management and farm education.

Participants were selected accordingly:

Name	Organisation	Affiliation
DI Mag. Dr. Josefa Reiter-Stelzl	Federal Ministry of Agriculture, Forestry, Environment and Water Management	Representative of the Ministry
Prof. Mag. Wilhelm Linder	University College for Agrarian and Environmental Pedagogy	lecturer
Dipl.-Phys. Dr. Tomas Hahn	University College for Agrarian and Environmental Pedagogy	lecturer
Mag. Ilse Wenzl	University College of Teacher Education Lower Austria; AECC Biologie Department Vienna	lecturer
Mag. Dr. Martin Scheuch	AECC Biologie Department Vienna	post doc
Ass.-Prof. Mag. Dr. Suzanne Kapelari, MA	AECC Biologie Department Vienna	Head of the AECC Biologie, University Vienna
Varga Julia, BSc.	AECC Biologie Department Vienna	project assistant, student
Mag. Dr. Prof. Franz Radits	University College of Teacher Education Lower Austria	lecturer
Mag. Elisabeth Nowak	University College of Teacher Education Vienna/Krems	Planungsbereich Naturwissenschaft und Technik
Mag. Peter Pany	Sir Karl Popper Schule/ Wiedner Gymnasium; AECC Biologie Department Vienna	teacher
Mag. Heidemarie Amon	Akademisches Gymnasium Wien; AECC Biologie Department Vienna	teacher

Mag. Elisabeth Inschlag	University College of Teacher Education Lower Austria; Secondary School for Economic Professions Wiener Neustadt	lecturer and teacher
Mag. Manfred Bardy-Durchhalter	University of Natural Resources and Life Sciences, Vienna; AECC Biologie Department Vienna	Zentrum für Globalen Wandel & Nachhaltigkeit; GLORIA - Global Observation Research Initiative in Alpine Environments
Mag. Dr. Ilse Bartosch	University of Vienna	Faculty of Physics/ Fakultät für Physik Fachdidaktik
Mag. Franz Dorn	University College of Teacher Education Vienna/Krems	lecturer
MMag. Dr. Marianne Ullmann, MSc.	University College of Teacher Education Vienna	lecturer

3. Workshop Agenda

Title: MASCIL Project workshop

Date: 19.05.2015: 10 -14 h

Place: seminar room, Austrian Education Competence Center, University of Vienna
Porzellangasse 4/2/2 1019 Vienna, Austria

3.1. Program:

10.00 – Short Introduction to MASCIL: project Idea and aims and outcomes,
10.30 website.

10.30 – Small Group Discussion:
11.30 1. What are the incentives for linking science education to the world
of work and what can be done on national levels to motivate
teachers and educators to implement inquiry-based science teaching
(Groups of 5 People , short group presentation to summarise
outcomes)

2. How can we improve farm education activities to link science and
agricultural research and landscape management activities
(Groups of 5 People, short group presentation to summarise
outcomes)

- 11.30 -11.45 Coffee Break
- 11.45 -12.00 Presentation: The Erasmus * Funding Scheme
- 12.00 -13.45 Plenary discussion on the of developing a proposal for March 2016
- 13.45 -14.00 Workshop wrap up
Setting dates for proposal development process up to March 2016
Feedback from participants

3.2. Summary:

Number of Participants: 15

Name	Organisation	Affiliation

3.2.1. Workshop objectives:

The workshop aimed to reach two main goals:

1. To discuss and found a working group which will develop joint mascil-teaching material addressing the topics of the world of work in agriculture, horticulture and landscape management
2. To discuss the potential of developing a joint, international training course for in service teachers and learning outside the classroom educators. This course will focus on participants becoming professionals in environmental and agricultural education.

3.2.2. Mascil teaching material

Another aim of the MASCIL policy workshop is to improve and develop teaching material, especial with mathematics aspects. The material should foster an opportunity for open discussion inside the classroom. Ongoing evaluation should enhance the material.

The themes, which are the results of first considerations, are farming garden, soya at the Danube and soil.

3.2.3. Master Course in Environmental Education

The objective of the workshop was to initiate a discussion among invited actors whether and how to develop a joint bachelor/master study for teachers and environmental educators in the future. The curriculum will put emphasis on applying inquiry based teaching and learning approaches to link science and mathematics to the world of work of farmers and landscape managers.

The workshop sought to stimulate more concrete thinking on this topic and organize a discussion around the following key questions, including:

1. What are the incentives for linking science education to the world of work
2. What can be done on national levels to motivate teachers and educators to implement inquiry-based science teaching
3. How can we improve farm education and link it to science and landscape management activities

The ultimate goal is the formation of a small working group developing a Project proposal for the Erasmus⁺ KA2 Call in March 2016.

The discussion covered three broad topics:

1. Clarifying concepts around linking research to practice and knowledge gained from research to the world of work
2. Finding solution for supporting the implementation of IBL in the context of agriculture and landscape development
3. Clarifying the design of a joint master program while taking different knowledge backgrounds, educational goals and organisational structures into consideration which are characteristic for the various institutions involved
4. Clarifying the Process how we should take the idea of writing a project proposal forward.

Clarifying the concept:

Participants clarified that Inquiry Based learning (IBL) and the world of work in agriculture and landscape management matches very well as many phenomena are directly observable when working on the farm or afield. However it will be a challenge to convince farmers, teachers and experience farm educators to give IBL a try as they already get good feedbacks from students attending their programs. Thus there is no obvious need to change the teaching approach.

Find solutions:

The Austrian curriculum focusses on supporting students to become scientifically literate and science competence and skill development are major goals. However students hardly ever experience inquiry based science learning in class¹⁰. Thus we assume that training practitioners in IBL is the only way to implement IBL teaching sustainably in Austrian classrooms.

Most workshop participants like to take the change and design a training course for farm educators and teachers to make students farm visits or fieldtrip activities more inquiry based. Linking this teaching approach to the world of work to help students learn more about how farmers do their jobs and why it is important to think about landscape management seems to be tempting. They think it is important to offer particular training for educators (which are people who predominately have studied biology, agriculture and landscape management at university but rarely hold a teaching degree) to become professionals in the field of farm and environmental

¹⁰ Grafendorfer, A., & Neureiter, H. (2009). Unterricht in Naturwissenschaften. In C. Schreiner & U. Schwantner (eds). PISA 2006 Österreichischer Expertenbericht zum Naturwissenschaftsschwerpunkt. Leykam, Graz, Austria.

education. A university degree will help them to improve their knowledge about teaching and to get better paid jobs.

Clarifying the Design:

There was mutual agreement that a joint Bachelor or master study is a very good option to train teachers and educators to learn how to link IBL to the world of agriculture and landscape management. This master study will support them to impart knowledge gained from research and from practice.

A joint study needs to fulfil given requirements such e.g a master study needs to cover 120 ECTS/a bachelor 240 ECT, participants need to write a master/bachelor thesis etc.

However the detailed structure will be a matter of consideration at a later stage.

The joint bachelor/master study will assemble various modules and each participating institution will hold responsible for particular modules. Students will register for these modules at different institutions. Before this will be possible the legal framework for degree programs need to be revised. So far it is difficult to run a joint study course as students need to register at all those institutions involved. Otherwise they will not be counted as a student at a particular institution. However this may lead to a high amount of student fees as students may have to pay at each institution individually. *(This is a matter of administration which need to be solved).*

It is important for each institution to choose the lead for modules which they can cover in terms of personnel and expertise.

Clarifying the Process:

All participating institutions are interested in handing in an Erasmus+ KA2 proposal. HAUP has a very experienced office for EU –partnership and project development. Thus HAUP will take the lead to run the development process. University of Vienna and ... will support the writing process.

We need to invite partners:

HAUP will be responsible to contact *Nationpark Neusiedler See* and the *Landwirtschaftliche Lehranstalt* as well as ... *School* will be contacted and asked whether they are interested to join the consortium.

University of Vienna will be responsible to contact German partners e.g. National Park Bayrischer Wald, the University of Applied Science Weihenstephan and the Pedagogical University Freiburg

The Proposal working group will meet for the First time in June and will develop a working agenda and meeting dates.

Proposal Working Group:

The Group will meet the first time on the 10th of June 2015 and will develop a working agenda and will set up dates to finalize a project proposal by February 2016

Members:

Lindner		
Scheuch		
Kapelari		
Reiter-Stelzl		

4. Main Outcomes and Policy Recommendations

Main outcomes and policy recommendation drawn from the workshop are:

1. It is important for all formal and informal education institutions to support K12 students to link school knowledge with knowledge they may use in the world of work and in their daily life.
2. Supporting this knowledge gaining processes in an inquiry based setting is challenging for students and teachers alike. Thus we need to do more research on what are phases of effective learning in inquiry based teaching.
3. To develop theory based teaching material which is successful in supporting teacher's professional development in inquiry based teaching we need to do more research and pool resources from different formal and informal teacher training institutions in Austria to tackle this challenging task.

1.13 National Policy Paper : Bulgaria

Jenny Sendova & Petar Kenderov

1. INTRODUCTION, APPROACHES AND METHODOLOGIES

The IMI-BAS MASCIL Team consists of researchers in mathematics, and in education in mathematics, IT and informatics. Natural Science education is not reflected in this report. Furthermore, IMI-BAS is not involved directly in the pre-service training of teachers. Our team however undertakes measures to influence the pre-service training of teachers in the corresponding universities. For instance, one of the focuses of the Annual Conference of the Union of Bulgarian Mathematicians (April 2015) was the use of ICT in the Mathematics education at university level. IMI-BAS actively participates in the education of doctoral students willing to get a PhD degree in mathematics education (covering pre-primary, primary and secondary level).

As explained in the “National Report for Bulgaria” the notion of “Inquiry Based Mathematics Education” (IBME) is not explicitly mentioned in the official documents regulating the educational system in the country and is still not recognized and promoted publicly. Until 5-6 years ago the notion had been used mainly in specialized journals and rather rarely in public media. After a comprehensive analysis and taking into account the work and conclusions reached with regard to WP2, the Sofia team decided to work simultaneously in several major directions:

1. To promote the ideas of IBME with all possible means (publications, interviews, seminars, workshops, conferences, etc.) in order to change the attitude of the society to IBME;
2. To introduce as many as possible teachers to IBME and select among them a group of teachers who, after passing a professional development course, would serve as MASCIL multipliers applying the cascade model for disseminating IBME in Bulgaria;
3. To develop educational resources and initiatives that would naturally involve teachers and school students in implementing the methods of IBME;
4. To involve state-, social and private organizations as well as school and university students in the dissemination and implementation of IBME;
5. To analyze on regular basis the strengths, weaknesses, opportunities and treats (SWOT) related to implementation of IBME in Bulgaria.

Item 1. The Sofia team reported in the P2_Interim report (as work done till the end of May 2015 with regard to WP7) 52 cases of promoting and disseminating IBME in the country. These cases include interviews on national television channels, national radio stations, electronic media, newspapers, specialized journals and magazines, publications in conference proceedings, etc.

In addition 13 more events were reported as “**Another type of dissemination activities** (which do not fit the ECAS)”. These were professional development courses organized by a well-known international firm RAABE which offers educational services in many countries. Members of Sofia MASCIL team were invited to serve as lecturers in these courses. Even more, since they were invited to propose the content of the courses, the Mascil lecturers developed handouts “saturated” with IBME methods and examples. Since the participating teachers were from different places in the country, these courses had a good dissemination effect.

The plans for the future:

The efforts of our team in promoting the ideas of IBME in Bulgaria should go on till the end of the project together with other actions undertaken in the frame of MASCIL.

Item 2. The opportunity offered by RAABE was used by the Sofia Mascil team to test (in terms of content and didactics alike) many of the scenarios and guidelines developed in the framework of MASCIL project. The participating teachers got introduced to IBME by being encouraged to take the role of their students and experience themselves (i) solving problems designed by the team in inquiry style as well as (ii) reformulating traditional problems in inquiry based style. Many other actions for introducing and implementing IBME in Bulgaria are described in our P2_Interim Report. Most notable are the four Workshops on IBME and its implementation organized till now. Each of the Workshops has being held during one of the two biggest events in the field of mathematics education in Bulgaria. The first is the National Seminar for Education in Mathematics and Informatics, organized annually by IMI-BAS in December. The second is the Annual Conference of the Union of Bulgarian Mathematicians organized at the beginning of April. Both forums comprise researchers, teachers, representatives of educational authorities and even high school students from the whole country.

The conduction of a Workshop on IBME and its implementation within the framework of these events attracts the attention of a significant number of teachers and policy makers and provides an opportunity to discuss IBME from nationwide perspective. Three of these forums were used also to have discussions with the members of the National Advisory Board. As said above, four such Workshops have already been organized successfully so far. The floor in the last one (April 2015, two slots of 40 min each) was given to six of our MASCIL multipliers (**Stella Kokinova, Galya Pencheva, Boryana Kuyumdzhieva, Diana Vassileva, Darinka Valkova and Roumiana Angelova**) who delivered examples of their practicing IBME in- and beyond classroom setting .

From point of view of MASCIL multiplier preparation, the most important event was the 128-hour Professional Development course “**Inquiry approach in Mathematics education**” organized by IMI-BAS and the Ministry of Education and Science (MES) in Sofia in the period July 4th – August 15th, 2014. Twenty two mathematics and IT teachers were subjected to a specially designed two- phase course including face-to-face instruction and work on teachers’ own projects.

The major part of the teachers participating in the course described above took also part in a MASCIL seminar for teachers “**Dissemination of Inquiry Based style of**

Education " and a **Poster session** (with resources developed by multipliers) organized in the frame of the UNESCO International Workshop *Quality of Education and Challenges in a Digitally Networked World QED'14 (Sofia, October 30 -31, 2014)*. The MASCIL Problem of the Month "Bicycle Insurance" was tried out, elaborated and discussed during this seminar, with the participant working in teams. This placed the project MASCIL into international perspective and our efforts on its implementation in Bulgaria. The reaction of UNESCO Workshop participants was very favorable and rewarding. A good description of the seminar and the workshop (in Bulgarian) is available at [http://www.math.bas.bg/omi/mascil/docs/QED Mascil site new.pdf](http://www.math.bas.bg/omi/mascil/docs/QED_Mascil_site_new.pdf) .

Some of the multipliers already started to conduct introductory courses for IBME themselves. So far four such courses have been organized and conducted:

Nelly Stoyanova and Radoslav Radanov, delivered one-day course with teachers from Dobrich in September 24, 2014;

Daniela Kouncheva organized 3 one-day courses on IBME with teachers from the region of Selanovci (6 teachers) and from the village of Ostrov (4 teachers). The courses took place on 7th, 12th and 19th of November 2014.

Maria Brauchle delivered an 8 hour Face-to-Face basic course for teachers on IBME. The two hour sessions took place on March 10th, 11th, 17th and 18th 2015. The face-to-face phase of the course was followed by a work of the participants on their own projects. Then these projects were presented and defended in several separate sessions of the group. The total course was designed as a 32-hour course. !6 teachers took part out of them 13 got a certificate.

MASCIL multipliers took part, upon invitation, in the **National Scientix Conference** – Sofia, 7-8 December 2014, with a talk or with a poster presentation on their good practices in using MASCIL resources. The schedule is available at: <http://www.math.bas.bg/omi/nso/?cat=14> .

At the same event the translation of **MASCIL Toolkit** in Bulgarian language was presented by the team member (and a multiplier) **Albena Vasileva**. It provoked significant interest.

The plans for the future:

- a) Two more intensive courses (such as the above mentioned Professional Development course "**Inquiry approach in Mathematics education**") with 20 "multipliers to be" each will take place this summer (2015). They are organized under the same scheme - jointly by IMI-BAS and MES. If necessary such courses will be organized in the summer of 2016 too;
- b) The two annual MASCIL Workshops (December 2015 and April 2016) will take place till the end of the project and will serve the need to introduce the new developments taking place in MASCIL and to strengthen the network of multipliers;

- c) The multipliers will work on the dissemination of IBME using the existing and/or newly developed tools (Problems of the Month, MASCIL Toolkit, Sofia team resources, etc.).

Item 3. Sofia Team maintains a Bulgarian version of the MASCIL website at <http://www.math.bas.bg/omi/mascil/> . It contains almost all of the resources posted on the original site of MASCIL.

In addition, a Virtual Mathematical Laboratory (VirMathLab) was developed containing hundreds of dynamical Geogebra files that can be used by teachers and students in the process of teaching and learning (<http://www.math.bas.bg/omi/cabinet>) in inquiry based style. As of the end of May 2015 VirMathLab (Figure 1) contains more than 900 such environments. The VirMathLab is available online to all schools.

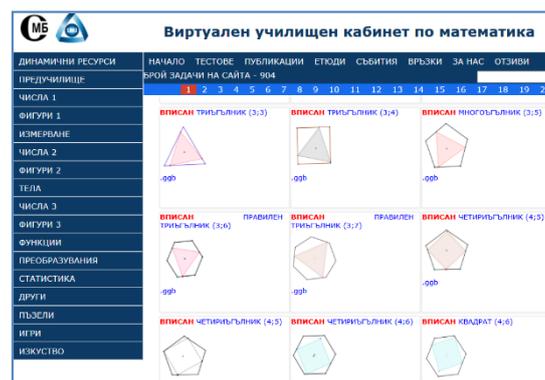


Figure 1. Virtual School Mathematics Laboratory: dynamic files for tackling an open geometric problem

Important feature of the *VirMathLab* is that it is being dynamically enriched by resources developed within educational projects (e.g. Mascil) with two-way links. For instance, the dynamic *Snowflakes* file (<http://www.math.bas.bg/omi/mascil/task-Snowflakes-bg.html>) is linked to the scenario “Let us make a snowflake” within the *MaSciL* project which in turn refers to the *Snowflakes* file (Figure 2).

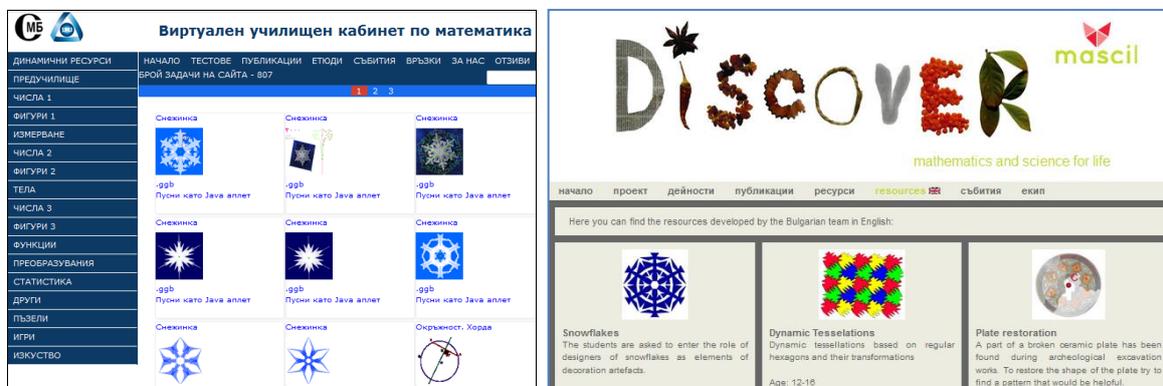


Figure 2. The sites of the VirMathLab and Mascil at IMI-BAS

Every dynamic file could be used as a means for providing conditions for explorations, visualization of the solutions, testing and self-testing, creating and formulating mathematics problems, solving practical problems with a specific

precision, motivation for mathematical or programming activities, acquiring skills for working with a specific software, development of algorithmic thinking, etc.

The way teachers are encouraged to use these resources is to stimulate students to behave like working mathematicians: to look for patterns while carrying out experiments, to make conjectures, to verify them experimentally, to modify/generalize the problem, and even to use them as a preparation for a rigorous proof. To do this without leaving their comfort zone, the teachers enter the role of their students and experience the same type of activities. They first use the dynamic files supporting the scenarios as a ground for explorations. The next step for them is to propose appropriate modification of the files for similar problems, or to use them as a model for creating one of their own from scratch.

Teachers use it in their class lessons, and the students – for self- learning. Besides, VirMathLab turned out to be useful in PD courses for teachers. How to use VirMathLab was demonstrated also at the Workshop with policy makers. Two TV interviews with representatives of the Mascil team and participants in the National Policy Workshop were dedicated to the implementation of the IBME by means of VirMathLab.

The plans for the future:

Translation into Bulgarian of materials developed by MASCIL Consortium members will be continued. The development of educational environments for VirMathLab will be continued too. It is intended also to supply many of the files in the VirMathLab with didactical guidelines how to use them in inquiry based style.

Item 4. Till now (end of May 2015) a number of organizations have been involved (to one degree or another) in the realization of the activities related to MASCIL Project. These are: The Ministry of Education and Science, the Bulgarian Academy of Sciences and its Regional Academic Centers, the RAABE firm (see above), the Union of Bulgarian Mathematicians (and its local branches), the Foundation “Enlightenment” , The Foundation “Parents, Teachers, Children” (<http://www.frud.bg/>).

The High School Students’ Institute of Mathematics and Informatics (HSSI) is a specific form of involving school students into the highest level of inquiry based education (the so called “4-th level IBE”). They work (as a beyond class activity), on open-ended problems (called “projects”) under the supervision of a more experienced mentor and present the results in the presence of peers and a scientific jury twice per year (in January and in April). A three week Summer Research School is organized in August for the best students from this group. This form of IBME exists in Bulgaria since the year 2000 and gives very good results. The graduates of HSSI regularly get awards from European and American Science Fairs and Competitions. Some of them even publish papers in specialized mathematics journals. A recent development shows that university students who are HSSI alumna become mentors of the next generations HSSI members. This is a way to involve university students in IBME both in the role of researchers and mentors. HSSI is supported financially by several foundations : “Eureka”, International Foundation “St Cyril and St Methodius”, “America for Bulgaria Foundation” and other organizations

Another development of the 4th level of IBL is the extension of HSSI to *High School Institute at the Bulgarian Academy of Sciences* established in the autumn of 2014. It includes mathematics, informatics and IT together with all the natural sciences (BAS). Two poster sessions were presented in November 2014 at the Central Building of BAS by the students, the jury comprising professors from the various institutes of the Academy (including members of the Mascil team).

Another form of “activities beyond class” and direct involvement of school students into Inquiry based learning was introduced in 2014 by IMI-BAS. It is a competition called “Mathematics with Computer”. It is conducted twice per year and prompts the students to solve mathematical situations (arising from practice with the help of GEOGEBRA dynamic software environments. The last competition in April attracted more than 250 participants. The competition is supported financially by the telecommunication company VIVACOM

The plans for the future:

- To keep increasing the number of organizations contributing to the dissemination of IBME in Bulgaria.
- To develop further the forms for direct involvement of school students into beyond class inquiry based activities.

Item 5. The SWOT analysis in relation to the implementation of IBME is performed periodically. As a result of such an analysis it was observed that the high-level policy makers (ministers, their deputies, etc.) do not need to be convinced for the advantages of IBE. They know this but their understanding is that there are always “more important problems” to be solved before dealing with IBE. This meant that implementing IBE with administrative means (“orders from above”) could not be carried out during the existence of the MASCIL project. As a conclusion, the Bulgarian MASCIL Team decided to use “grass-roots-approach” and turned its attention to “middle-level” policy makers without whose “blessing” nothing happens in the Bulgarian Educational system. These are the Regional Inspectorates in Education (RIE). Based on this approach a three-day seminar was organized in Bankia, near Sofia, already in February 2014. There were 30 participants, mainly heads of RIE in the country. They were introduced to the methods and potential of IBE. The second step was focused more closely on the experts in Mathematics and IT from the Ministry of Education and Science (MES) and such experts from RIE.

These are the people whose approval and support for IBE is crucial for the success of the Mascil Project. This is why the National Policy Workshop (NPW) was especially oriented toward them (February 2015). The last meeting of NAB has taken place during the NPW and this turned out to be a very good idea.

The workshop provoked the participants to step in the shoes of the students and play with resources from VirMathLab and Mascil Resources (including 3 problems of the

months, dealing with Bicycle insurance, Counting, and Design of a parking entrance to a basement garage, Figure 3).



Figure 3. Resources published on the Bulgarian site of the Mascil project used at the NPW

Similar considerations revealed that the regional *Mathematics and Natural Sciences Schools* (about 30, one in each big town in the country) also have the potential of disseminating IBE. Moreover, the majority of educational innovations come from these schools. This is why an IBE seminar for headmasters of these schools was organized in Stara Zagora (January 18th, 2014, listed as [13] in the P2_beneficiary report) . Both categories (RIE experts and headmasters of *Mathematics and Natural Sciences Schools*) have to be kept in the “high priority” list of MASCIL actions.

2. DOCUMENTATION OF THE WORKSHOP

At the end the participants at NPW (and the members of NAB) were kind to answer the following two questions:

- *How do you see the potential of the IBL in a class setting?*
- *What are the main problems of its implementation?*

Here are their answers grouped accordingly:

Regarding the IBL potential and the use of dynamic geometry software:

- *The IBL will enhance the motivation for thinking and learning of the students and the teachers alike*

- *The IBL could be used in the IT classes and in integrated (binary) lessons*
- *The IBL is applicable only partially in the obligatory classes, it could be used mainly in the selective classes, and in the context of work on projects*
- *The IBL would have a very strong effect on the students' motivation, interest and endeavor to knowledge*
- *The IBL could be successfully applied in the out-of-class activities, and especially in the vocational schools; the IBL should be disseminated among the teachers, among the students, by means of the social networks and the media; all the methods and tools by means of which the teachers could convey the beauty of mathematics to the children are useful*
- *Using dynamic geometry software is appropriate for modeling various real phenomena and processes; the use of dynamic geometry software is useful for preparing drawings for problems for math contests (?!)*
- *GeoGebra is a powerful tool for visualization and for exploration of complex situations; the IBL could be applied in mathematics classes **if wisely used***
- *The conditions for implementing IBL in school are: to change the existing syllabus, to educate the teachers to work in this style, to equip the schools with the necessary technical resources.*

Regarding the problems of IBL implementation:

- *More practical seminars and workshops with teachers are needed*
- *The literature with tasks and problems appropriate for IBL is not sufficient, or at least not well spread*
- *The main problem is how to motivate the teachers to get ready for implementing IBL in their practice*
- *A significant problem is the lack of time; the qualification of the teachers is insufficient*
- *There is lack of appropriate equipment; the relatively high average age of the teachers could be a serious problem and a reason for indifferent attitude to innovative approaches.*

On 10/02/2015, Chanel 2 of the Bulgarian national television broadcast a 1.36 min reportage with participants of the Policy-makers Workshop. The interview is available at

<http://bnt.bg/bnt2-regionalni/bnt2-sofiya/nova-virtualna-klasna-staya>

3. SUMMARY AND CONCLUSION

3.1 The experts from RIE as a main potential supporter of the IBL implementation

The general understanding is that the experts from RIE have a great and unexhausted potential to intensify the process of implementation of IBE in the country. To do so, they have to get additional help and preparation (even to the degree of making them a special type of MASCIL multipliers). While in the country there are many programmes for Professional Development (PD) of teachers, none of these programmes is turned directly to experts from RIE. It creates tensions when a teacher from a certain region starts implementing something new (say IBME) and the regional expert does not know what it is about. Therefore, a greater number of seminars have to be organized for local experts. Also PD courses for teachers from a certain region are more successful, if they are organized by a representative of RIE in cooperation with the local branches of the Union of Bulgarian Mathematicians (UBM). This means that heads of the local branches of UBM (which, in majority of cases, are teachers) should also be involved in the network of MASCIL project.

Similar considerations apply also to headmasters of *Mathematics and Natural Sciences Schools*. They could play a prominent role in disseminating IBE.

2. Conclusions

The previous chapter provided a detailed account in each country of the processes and outcomes of the national policy workshops that took place within the WP2 of the mascil project, aiming at engaging in a reflection and negotiation process policy makers on how to contribute to a widespread uptake of inquiry based approaches in rich vocational contexts. As evident in the national papers, ***the main aim of the task has been successfully achieved*** as we managed to ***implement 12 national workshops*** in Germany, Greece, Netherlands, Spain, Cyprus, Norway, Romania, Czech Republic, Turkey, Lithuania, Austria and Bulgaria, ***establishing dialogic process with more than 250 influential stakeholders*** (policy developers and implementers). The methodological procedures that we followed allowed to ***successfully address the two main challenges that we faced*** during the conduction of the work: ***the active engagement of policy makers*** – achieved by the careful selection of participants with the aid of the national advisory boards (NABs) – and ***the diversity among the participants countries*** – addressed by allowing flexibility in workshop methodology, in the target groups selection and in the focus on the topics discussed in each workshop.

This chapter provides an ***overview of each workshop case*** by highlighting the ***strengths, weaknesses, opportunities and threats (SWOT analysis)*** in the dimensions of: ***planning, networking, implementation, outcomes and reporting of*** each workshop. Such an overview serves two purposes within mascil: First to ***guide further activities in the project*** – in particular those that involve policy makers- by identifying the elements that contributed to the success of the work conducted and by pinpointing difficulties that have been (and should further be) addressed in order to meet project objectives. Second, this work ***will lay the ground for the analysis of the outcomes of the policy workshops***, that is schedule for the next phase of work within WP2, by providing axes of the analysis of the national papers in order to produce a plan of action on how best to involve policy makers into the project endeavour - which will turn into action via further networking activities in each counties (Final Policy Paper, due December 2015).

The case of Germany

Prominent issues on processes and outcomes of the policy workshop in Germany, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Support and strong interest from the side of other mathematic educators from the University of Education Freiburg Addressing up-to-date respectively significant topics	Timing, work overload; challenging to fix the date and to raise the interest of the stakeholders
External	Establishment of a new curricula; Focus on "new competences"; Possibility to address the topics "IBL competences and WoW"	Structural instability, since several years there are many changes in curricula, many challenges that teachers have to face in their day to day teaching

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Strong support from mathematic educators from the University of Education Freiburg; Reaching participants who are really interested in the topics, resulting in a high quality of the workshops	Stakeholders are very interested but have a very tight schedule
External	Addressing the workshop to the lower policy level like regional school authorities and persons who are responsible for the organization and establishment of PD activities in the region, they decide about the implementation of PD courses	If we do not reach the policy makers we cannot expect changes on the policy level As mostly mathematics educators were involved in the policy workshop topics relating to science can be treated marginally

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Possibility to address specific topics, adapted to the interest of participants/stakeholders -> to ensure high quality of the meeting	A lot of organizational efforts needed. Impossibility to bring together all different target groups to support the cooperation and communication between them.
External	To affiliate the German mascil policy workshop to an another educational event -> reaching even more participants and experience different points of view	None

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Very concrete recommendations for policy makers about supporting the connection between schools and World of Work Establishment of a cooperation between regional school authorities and the University of Education Freiburg in terms of designing/arranging/offering long-term professional development	Focus on selected topics; in particular on - Cooperation related to organize/run PD courses. - Connections of schools and the WoW IBL was addressed only marginally
External	Corroborate the establishing cooperation by signing a formal contract between school authorities and the University of Education Freiburg Discussion about the connection between schools and WoW has been initiated among diverse groups (teachers, parents, policy makers) Importance of this issue was stressed	Due to a lot of changes in the educational structure it can happen that the outcomes of the policy workshop attract not enough attention of policy makers

The case of Greece

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Our research team has wide experience in planning and implementing workshops engaging policy makers (other projects and networks in which team participates/coordinates)	Challenging to fix the date, so as to ensure engagement of policy stakeholders
External	Establishment of new curricula for upper high school in line with mascil objectives.	Not evident

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Establishment of good connections with the Institute of Educational Policy (IEP) via the EPNoSL network and with policy stakeholders via mascil NAB.</p> <p>The resources that we distributed to the participants before the workshop (based on the analysis of national contexts) is believed to engaged them in participation.</p>	Not evident
External	Address the workshop to lower policy making level and policy mediation level.	Participation due to policy makers tight schedules

Implementation method

Helpful to achieving the objectives	Harmful to achieving the objectives

Internal	Method of analysis of the national contexts and educational system, structured and detailed work that feed the content of workshop and directs the implementation method (EASW setting)	EASWs implementation relies on stakeholder balance, which might never be reached realistically.
External	EASW setting allows for interaction between stakeholders - rather than in which presentations are provided to participants and aim for consensus building rather than instructional approach (appropriate methodology for the policy workshop aims and objectives)	EASW setting relies on participants active participation

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	The methodology followed allows comparison of outcomes of discussion (opportunities and difficulties) of the views of various levels of policy (meso-micro-micro)	Not evident
External	Recommendations that resulted from the negotiation process between stakeholders from various levels of policy (micro-meso-macro)	At the moment no binding from policy for further collaboration, follow up actions are needed.

The case of the Netherlands

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	We announced the information about the workshop in newsletters, so the name mascil was used frequently.	We used only 2 months prior to the meeting to start advertising.
External	Many colleagues have projects or initiatives in this area and are interested in policy supporting it.	Policy doesn't feel responsible to support the organization of this workshop (to create ownership).

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	An important combination with the Dutch Platform Beta-Techniek (PBT) was established (they are close to the ministry of education)	We were not able to attract more representatives from industry.
External	Many colleagues have projects or initiatives in this area and are interested in policy supporting it.	It is (still) not clear for stakeholders from industry what is in it for them? They have other priorities (making money)

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	A lot of people from the policy meeting are also involved in the NAB	It is only one meeting
External	Colleagues and policy makers want to know what is going on in this area in the Netherlands.	People are busy. Finally they will cancel this meeting (low priority for them).

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	The three workshops gave insight/information about developments related to IBL and WoW in science & math education in primary, secondary and vocational education.	We have only one presentation (pdf) as documentation of the three presentations.
External	It is easier for us to reach colleagues and people from PBT for further policy initiatives. With our colleagues we created more synergy in and a better articulation of our aims (easier for policy to take this into account).	At the moment no continuation of or support from policy for further collaboration.

The case of Spain

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Mascil aims are aligned with current educational policies. There is a need of improving students' mathematical and scientific competencies. Also teachers' initial education and their professional development.	Mathematics and science teaching and learning seems not to be in front of the educational policy discussions.
External	To strengthen the need of reflecting on how mathematics and science teaching should be organized in order to meet curricular demands. And to connect this with the consequent professional development of teachers.	Mascil approach could be perceived as something complicated, or just for gifted students. Sometimes it is difficult to perceive how Mascil is pointing in the same direction as national policies in relation with the teaching of mathematics and science.

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Good connections with some policy makers within the Regional Ministry of Education, through their inclusion within our NAB.	Policy makers' busy agenda. Not easy to make them attend a meeting, and to make them see that Mascil can be a powerful tool in the implementation of their policies.
External	To widen our connections with other policy-makers	Not succeeding in attracting policy-makers. Not succeeding in matching policy-makers priorities with the actions promoted by Mascil.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	An important and focused set of policy makers has been attracted. They are in a level within the Regional Ministry of Education where decisions are taken.	A very restricted group. It would become problematic if some of them leave his/her position, or his/her interest decreases.
External	A much focused discussion around the themes we really wanted to discuss.	That the interest and the engagement of some of the policy-makers involved decreases.

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	The decision of exploring the creation of a specific action, within the “plan and programs” scheme. This would be focused in the teaching of mathematics within Primary and Secondary schools, and would include several strands. One of these strands would focus on enriching the teaching and learning of mathematics through IBL and problem solving.	Further work is needed: defining the scope of the “program”, its aims, structure, timing, contents... So far, there is a mutual interest in exploring this solution, but has to be worked out in the future.
External	A different way of reaching teachers and schools beyond the PD courses that we are running in collaboration with some Teachers Centre. It is a good opportunity since schools would be working as a whole to implement IBL, with in-school PD actions and the support of experts.	Regional elections were celebrated 4 days after the NPW. This can lead to changes within the Regional Ministry of Education that might affect our plans.

The case of Cyprus

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	We had access and connection to policy makers (people in the Ministry of Education and Cyprus Pedagogical Institute) which made it easier to contact them.	Bringing all policy makers together was not easy because of their busy schedules.
External	After presenting Mascil ideas to Cyprus Pedagogical Institute we were invited to offer a seminar to in-service teachers.	None

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Networking was easy because we were familiar with several of the policy makers. Policy makers were overall engaged with the workshop – especially because we had to meet them in small groups because of time constrains.	Not all policy makers are familiar with inquiry-based learning in mathematics and science and therefore not all were engaged because of a different philosophy on how the subjects should be taught.
External	Opportunities to link some of the Mascil materials to the new curriculum that is currently being developed were raised by some of the policy makers.	Not all policy makers are familiar or agree with inquiry-based learning or the world of work.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Policy makers were invited in small groups of 4-5 people to attend the workshops.</p> <p>We presented ideas from Mascil (short presentations) and invited comments and discussions.</p> <p>One of our researchers recorded the comments and discussions.</p>	<p>We were not able to gather all policy makers in one workshop and so we had to meet different policy makers in different days/times. Therefore, we did not have the chance for an interaction between all participants.</p>
External	<p>Because of the small homogeneous groups we were able to have in-depth discussions with all participants.</p>	<p>Lack of interactions between all policy makers (because of how workshops were structured) means that we might have missed out on comments that would emerge from a diverse group of policy makers.</p>

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>In depth discussions because of small homogenous groups.</p> <p>Overall policy makers were positive and provided suggestions on how to connect Mascil materials and ideas to the new curriculum in Cyprus.</p>	<p>We were not able to bring together groups with different ideas (e.g. inspectors and people preparing the new textbooks) to discuss contradicting ideas and different concerns from each group.</p>
External	<p>We were invited to provide materials to be considered for the new textbooks and also to design a training seminar for in-service teachers supported by the Cyprus Pedagogical Institute.</p>	<p>None</p>

The case of Norway

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Based on last years' Building bridges event, initiated by INSTEM, Trondheim. Planned together with INSTEM, PLU. Dean of HiST sent invitations. Guest lecturer: Geoff Wake INSTEM representant: Peter Gray	School owners were not involved in planning; these didn't come to the event. Only 1 head teacher participated. Could have invited earlier (first email des). People are busy, many didn't come.
External	To have a more long term plan for the region. Strengthening the collaboration between projects. Better contact with Ministry and authorities, increased chance that they participated. Better focus on HiST.	Too little involvement of local school authorities means too little involvement of principles. Important people are busy; feel it is not important for them.

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	National centers (math, science, recruiting to sciences) were represented, Ministry (KD), Sør-Trøndelag county, Trondheim municipality, 1 head teacher	Lack of continuity, new representative from ministry and county. Participants from Building bridges 2014 could not come. Thus a question of continuity.
External	Possible to make better relations to ministry and centers.	What is in it for me? Many projects fight for attention. Danger that few know about the project and doesn't prioritize it. No action plan was made.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Invitation was sent via email. Follow-up-event of Building bridges 2014. ½ day meeting at HiST, other half day with NAB. Guest lecturer. Presentations + group discussions (mixed groups) + plenary.</p>	<p>48 invited, 25 came, only one of them were a head teacher. Only face to face-meeting, meaning than those who couldn't travel were not able to attend.</p>
External	<p>Active discussions. Face to face: easier to get to know each other, to engage and discuss.</p>	<p>None</p>

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Manage to engage ministry (Lene Oftedal). Start communication with her. Vision of more cooperation settled, and alignment of projects an aim.</p>	<p>No commitments made.</p>
External	<p>Sharing resources, more cooperation suggested.</p>	<p>No action plan. Lack of time to administrate cooperation</p>

The case of Romania

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	local examples (good practices) that reflects the Mascil concepts and can be implemented in the Romanian context, even in rural areas both in general and in vocational schools existence of international materials, reports, recommendations	finding partners from industry; how to go beyond the concrete examples
External	link to regional or national events, list all possible events, with foreseen participants	invited people may not show up at the event even if they confirmed their participation; after the event the participants will go home like nothing happened

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	participants in the Mascil PD are from a lot of schools, villages, counties, so a lot of school directors, inspectors, local stakeholders can help the process because they know about what is going on in their school	local stakeholders do not have much autonomy in decision making, the curricula is centralized, so a very spectacular and short term result is not expected
External	the results of Romanian children on international tests are very poor, a link between inquiry based learning and the possible improvement of these results could be stimulating for stakeholders	if the local stakeholders, e.g. a school director, do not see an immediate, measurable benefit for their school (not for their students, but, for the school as a legal entity) they might be uninterested

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	it was organized in cooperation with several local organizations and it was linked to major contest involving more than 300 students and more than 140 teachers (including school masters, inspectors, university staff and other professionals) and more than 40 local firms	if the number of people is too large, they can perceive the event like another annoying, official meeting they have to attend
External	to reach a big number of stakeholders, local policy makers and also some people from the central administration	-waste of energy and resources on the project side because no quantifiable output will be produced, no result can be felt on a short term

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	the participants got a brief overview on what is IBL, what are the main constrains of implementing IBL in Romanian schools, what extra effort is needed from teachers and student in Romania in order to implement IBL activities	At local level the stakeholders can support initiatives and teachers, but they cannot change the centralized part of process (curriculum, national tests, etc.)
External	to work with several inspectors and school directors, who are (or were) basically teachers	the main threat is that everything remains on the level of interesting discussions

The case of Czech Republic

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Availability of information to workshop organizers on planned events of policy makers on the faculty/university level (intention to exploit the meeting of Association of deans of faculties of education of the Czech and Slovak Republics in Hradec Kralove).</p> <p>Valuable link and co-operation with the management of Faculty of Education, University of Hradec Kralove, who is the main guarantor of pre-service teacher preparation.</p> <p>Support from the faculty management.</p> <p>Close relations and contacts with policy makers in the field of pre-service teacher preparation in the Czech and Slovak Republics.</p> <p>Previous co-operation with some participants of the policy-workshop on projects and curricular documents.</p> <p>Detailed preparation of the project presentation and questions for discussion the WEB and banners of the Mascil project.</p>	<p>Focus of the workshop on management of faculties of education which are the guarantor of teacher education in the Czech Republic on one hand but on the other side in maths and science teachers' preparation other faculties also participate (e.g. f. of science, technology etc.).</p> <p>The Ministry of Education and Accreditation Commission was represented by individuals only, not by a group focusing on maths and science instruction.</p>
External	<p>The crucial 'players' in the field were addressed who are responsible for forming, realization and assessment of teacher education in the Czech and Slovak Republics.</p>	<p>Willingness to participate and acceptance of the workshop from participants – representatives of faculties of education management.</p> <p>Insufficient space within the schedule of the meeting of Association of deans of faculties of education of the Czech and Slovak Republics – workshop as an additional activity within the policy makers' meeting with different focus.</p>

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Strong interest in information on the Mascil project from managements of faculties of education from the Czech and Slovak Republics (most representatives had solved projects of similar type on national and international levels). Engagements of participants who had had their own experience in IBSE in practice and particularly in teacher preparation.	Limited time for the workshop within the meeting of Association of deans. Generally, low motivation to work with/fill in the tools of exploration (the survey).
External	Dissemination of existing results of the Mascil project, particularly in the field of structure and content of further teacher education in relation to career system which should be soon introduced in the Czech Republic and innovated in the Slovak Republic.	Low motivation of participants to discuss the presented problems which might have impact on the objectivity of information collected within the discussion and survey.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Presentation of Mascil objectives and philosophy, supported by the presentation and virtual walk on the Mascil web, including the previous events within the Czech Republic and photo-documentation.	Time for project presentation was short.
External	To open the discussion on forming curricular materials which will more focus on educational processes than on concrete learning contents of subjects. Possible initiation of follow-up workshops on given topics (IBSE, WoW) at partner institutions and maths and science forums (e.g. Association of Czech Mathematicians and Physicians, Czech Chemical Society etc.)	The trust in the possibility of such a radical change of curriculum for general and vocational maths and science education. Scepticism towards IBSE implementation as a new educational culture compared to its application as superstructure of the traditional approach to instruction.

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>Exploration of the survey for forming opinions on IBSE implementation into the educational environment in the Czech and Slovak Republics.</p> <p>Return rate of the survey as group activity of representatives of faculties of education managements.</p> <p>Collecting relevant information in each item of the survey.</p>	<p>Short time period for wider and longer discussions and answering questions in the survey.</p>
External	<p>Possibly more links and relations to the project solvers.</p> <p>Publish the course of project and results in professional journals.</p>	<p>Still open, accessible discussion which could support scepticism in IBSE implementation into common school reality.</p>

The case of Turkey

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Organizing the workshops with local authorities (like municipality of the region or director of Ministry of National Education) motivated the teachers and gave them ownership. This community is considered as making small community of practice.	There would have been more group meeting with policy makers.
External	Further collaboration has been arranged. For instance a STEM teacher conference will be organized in collaboration with Ministry of National Education on September 7-8, 2015.	It has been difficult to find a common meeting time for the policy makers. Therefore, after the first policy workshops they were visited individually.

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Following key actors have been visited individually. Mustafa Hilmi Çolakoğlu, Advisor of Minister of National Education Emin Karip, Ministry of National Education Kayhan Karlı, Innovative Learning Center Ahmet Eti, CEO, SEBIT Mascil Turkey Team presented an oral presentation at IOSTE Eurasia Regional Symposium & Brokerage Event Horizon 2020. http://www.ioste2015.org/ In total there were more than 150 participants from 24 countries	There would have been more stakeholders
External	In total at IOSTE Eurasia Regional Symposium & Brokerage Event Horizon 2020, there were more than 150 participants from 24 countries. Visibility of our research team and mascil project have increased in different cities	Because of high demand from director of Ministry of National Education we can't respond all teacher-training activities in their regions

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>First MASCIL (Mathematics and Science for Life) and INSTEM (Inquiry for Science, Technology, Engineering and Mathematics Education) project national workshop have been held together at Hacettepe University, Ankara on October 22, 2013. Afterwards, there has been several individual meeting with policy makers. For instance, during a workshop on STEM education in Istanbul, during at IOSTE 2015 Eurasian Regional Conference, a visit to advisor of Minister of National Education and during INSTEM conference in Freiburg.</p>	<p>The workshop should have been held in a longer period of time. All participants wanted to talk more but due to time limitation that was not possible.</p>
External	<p>Advisor of Minister of National Education and Director of Altindag Ministry of National Education have participated in mascil teacher workshops and gave a certificate to pre-service and in-service teacher who have completed 26 hours of mascil workshops over around five months. The participants implemented mascil activities in their classrooms and most of them wrote a case study based on their classroom practices. Participation of key actors are welcomed by the participants.</p>	<p>There is not a long-term cycle policies</p>

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>As a result of policy workshop, visibility of our research team has been increased in local media coverage and other social media coverage.</p>	<p>There would have been much clearer roadmap for future actions.</p>
External	<p>Production of national white papers. For instance a report on STEM education in Turkey has been written. The paper is available at: http://fs.hacettepe.edu.tr/hstem/dosyalar/STEMRaporu.pdf</p>	<p>No</p>

The case of Lithuania

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>We have several persons at the Mascil NAB from different education policy institutions, they are good helpers.</p> <p>Ministry of Education and Science of Lithuania declared STEM also one of their priorities and developed a national implementation strategy.</p>	<p>Shortage of time.</p>
External	<p>To plan an event as early as it is possible.</p>	<p>To lose some important partners.</p>

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>The members of a national STEM group are from industry, universities, schools, Ministry of Education and Science, and Educations Development Centre.</p> <p>The partners were invited by using different communication means (emails, calls, face-to-face)</p>	<p>Headmasters of schools were not invited.</p>
External	<p>Most of the stakeholders are workers of policy institutions and they might be invited earlier to workshop as they plan their events in advance. The headmasters of some schools could be invited also.</p>	<p>From the one side larger number of participants makes discussions very difficult and from the other there have to be at least two representatives from various policy positions to make discussions more helpful.</p>

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	The Mascil team relation to Lithuanian STEM group. The meeting face-to-face and moderating discussions to give opportunities to express their understanding and incites.	There were needs more time for discussions among educators, scientists and policy makers. Some of policy persons were very busy and they couldn't attend the workshop.
External	Balance between workshop time and productivity of workshop. To organize two or more meetings.	Too short the workshop time can cause superficial understanding.

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	All participants of the workshop understood the Mascil goals. Connection to STEM became stronger.	Not enough time to go into deeper discussions.
External	To make a workshop with invited speakers to be better connected to STEM and IBL.	Too short time of the meeting. Too light discussions.

The case of Austria

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	We managed to bring together people from various educational institutions which war currently not working together although they engage in the same areas of environmental education	We invited representatives of institutions who did not join the workshop. Some of them did not even reply ...
External	... other did not have time to show up but are interested to work with us in the future. Thus these people will be informed and invited to come to next meeting	No threats as we assume that those who have shown their comment already will continue to do that. However if one of the two ministries involved in the Austrian formal education system will halt the dialog.

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	People who came to the workshop are key players in the field and worked together very well	Some did not show up
External	Some are interested and may be involved in the future	No threats as we assume that those who have shown their comment already will continue to do that. However if one of the two ministries involved in the Austrian formal education system will halt the dialog.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	The Cooperation will lead to ready to hand outcomes e.g. teaching material and proposal for training course	To hand in the proposal in autumn will be tight schedule – March 2016 will be easier. However it is more motivating for all stakeholders to see results as soon as possible.
External	If the Erasmus Proposal will be accepted a long term partnership will be established	No thread – even if the proposal will not be accepted all involved stakeholder are committed to establish the master course without additional funding

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Concrete Schedule for meetings to continue working together	none
External	The cooperation will help us to develop high quality Mascil teaching materials and a high quality master course	Stakeholders might not be interested to continue working with us

The case of Bulgaria

Prominent issues on processes and outcomes of the policy workshop in the Netherlands, in terms of planning, networking and stakeholders' engagement, implementation method and outcomes:

Planning

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>When analyzing the situation of the country we arrived at the conclusion that it is not enough to work with teachers only. They have to enjoy the support and positive attitude of the local educational authorities (local policy makers).</p> <p>Since we identified a problem, we decided that the national policy workshop will have to involve many local policy makers on regional level (regional experts in mathematics, informatics and IT) so that they experience themselves the advantages of IBL in its connection with WoW.</p>	<p>We don't have a direct access to the local policy makers (regional experts in mathematics, informatics and IT) because they are under the regional expectorates and it is difficult to convince the inspectorates to send experts to workshops demonstrating the strength of IBL in connection with WoW.</p> <p>To overcome this problem we acted through the Ministry of Education and Science (MES) itself.</p>
External	<p>Changing the attitude towards IBL on local level is decisive for its dissemination and implementation.</p> <p>Without a favorable attitude, its spreading would be impossible.</p>	<p>The conservatism of the educational system as a whole and of regional experts, in particular. If not implemented properly the workshop could have achieved the opposite effect: Negative attitude towards IBL.</p>

Networking/Engagement

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	By conducting NPW we created a new network of educational experts with a great impact on the work of the schools under their supervision and the teachers in mathematics, informatics and IT. It is worth mentioning that two national experts from the Ministry of Education and Science (MES)– one in mathematics, and the other – informatics and IT showed their engagement by taking part in the NPW and helping with its realization.	The relatively short duration of the workshop cannot assure self-sustainability of the network and its independent functioning. Therefore additional efforts are needed for the stakeholder engagement, including further workshops, online support.
External	The support of the regional inspectorates is crucial for the implementation of IBL. This eye-opening message came to us by some teachers from the group of Mascil multipliers who encountered a negative attitude towards IBL on behalf of the local experts, and as a consequence – of the whole local educational inspectorates. It is advisable to have follow-up workshops with the same group so that the networking becomes more stable and the positive effect – irreversible!	Networking events have to be more frequent – in order to keep the networking process sustainable. Regional experts and those in MES are overloaded in terms of everyday tasks and do not have time and motivation to promote IBL directly. At the very least we have to make sure that they are not opposing IBL even if they do not actively promote it.

Implementation method

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	Demonstrating the advantages of IBL by delivering a workshop in IBL style – with hands-on activities with the Virtual math lab resources developed in the frames of the Mascil project.	Most of the participants were not advanced enough in using dynamic software in support of IBL. They did not expect the workshop would be focused on the use of a specific software environment (GeoGebra in this case) but rather on how to use it in IBL style.
External	Such courses will be organized for teachers on a regional principle. The implementation of the Mascil cascade method on regional level depends heavily on the attitude of the local experts. Thus, their favorable attitude is a necessary condition for the successful implementation and dissemination of the project goals.	Since IBL is not well spread in the country, and its effect on the students' knowledge is not easily measured by the traditional assessment scheme, some of the participants in the workshop may remain unconvinced in the advantages of implementing IBL!

Outcomes

	Helpful to achieving the objectives	Harmful to achieving the objectives
Internal	<p>A new target group important for the successful implementation of the Mascil goals was formed consisting of: regional education experts (in mathematics, informatics and IT), experts in Ministry of Education and Science. During the NPW a joint meeting was organized with the National Advisory Board (NAB), in which a serious discussion and brainstorming was organized concerning the status quo of the project and its implementation. The opinions of the NPW participants on the potential of IBL and the problems for its implementation on a broader scale were taken and summarized after the workshop.</p>	<p>Limited time. Only a fraction of the Mascil resources has been demonstrated. It is not to expect that a single workshop can fully change the attitude towards IBL of the traditionally shaped experts in education working in Regional inspectorates for Education.</p>
External	<p>The impact of the NPW is already felt in terms of the encouraging attitude toward IBL expressed by MES experts in the interview they gave on the national TV about the workshop (http://bnt.bg/bnt2-regionalni/bnt2-sofiya/nova-virtualna-klasna-stava) Valentina Arabajieva: This is beautiful, dynamic and time-saving. Then – it is interesting since the today’s generation cannot be taught with a marker on the white board.</p>	<p>Regarding the problems of IBL implementation here are the summarized opinions of the participants in the NPW: <i>The IBL could be applied in mathematics classes if wisely used</i> <i>More practical seminars and workshops with teachers are needed.</i> <i>The literature with tasks and problems appropriate for IBL is not sufficient, or at least not well spread.</i> <i>The main problem is how to motivate the teachers to get ready for implementing IBL in their practice.</i> <i>A significant problem is the lack of time.</i> <i>The qualification of the teachers is insufficient.</i> <i>There is lack of appropriate equipment.</i> <i>The relatively high average age of the teachers could be a serious problem and a reason for indifferent attitude to innovative approaches.</i></p>

3. Recommendations

Based on the identification of the elements that contributed to the success of the work conducted and as well as of the difficulties that have been addressed in order to meet work objectives –presented in the previous chapter- the following lines provide **recommendations for the mascil partners** in order to **guide further activities in the project**, in particular those that involve policy makers.

Planning & Networking process:

- In the process of planning, **helpful conditions** for engaging policy makers in reflecting and negotiating on mascil priorities are: Take advantage of new curricula that align to the projects aims (Germany, Spain, Lithuania); take advantage of connections and collaboration with other projects (the Netherland, the Czech Republic, Norway); participate in regional events that engage policy makers (Romania); careful selection of target groups (Greece, Bulgaria); focus on influential people (Germany); take advantage of NAB and PD networks within mascil (Lithuania, Romania)
- In the same time, the following **obstacles should be taken into consideration** when planning activities that involve policy stakeholders: difficulty in fixing dated that are convenient for all (Germany, Cyprus, Greece); it is difficult for policy makers to create ownership of projects' aims and outcomes (the Netherland); conservative educational system (Bulgaria).

Implementation process & Outcomes:

- The diversity among the participants' countries (cultural, thematic, applied methodology) is **a big challenge** that should be faced by **flexibility** in future action plans (in terms of methodology, in the target groups' selection and in the focus on the topics). Action plans for realisation of recommendations that emerged from the policy workshops should – at a first level - be national/local taking into consideration national conditions.
- Lot of changes and reforms take place in relation to curricula in recent years in most countries. In order **the outcomes and recommendations of the policy workshops** to attract the attention of broader policy audiences – and not be anticipated as short term initiatives that will be out of date in the near future- , they **should be embedded in the frame of broader education priorities** (such as equity, achievement, entrepreneurship) and communicated to the policy makers under such a rationale.

These recommendations are believed to be helpful in the course of **further networking activities with policy makers that have been planned** within the mascil project and especially in the process of **realization of the action plan on how best to involve policy makers into the project endeavour** (Final Policy Paper, due December 2015).

4. Appendix

Briefing Paper National Policy Workshops and National policy papers

Prof. Dr. Marcelo Parreira do Amaral
University of Münster
Dr. Kathy Kikis-Papadakis
Foundation for Research and Technology Hellas



Contact Information

Coordinator: University of Education Freiburg, Prof. Dr. Katja Maaß
Website: www.mascil-project.eu

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Briefing paper National Policy Workshops and National policy papers

The aim of this briefing paper is to provide guidance and support to partners in organising the *National policy workshops* (NPW) with policy makers (month 27) in WP2 (Task 4) and thus prepare the *National policy papers* (NPP) (month 30) in their respective countries. This guidance takes into account the WP 2 description as stated in the DoW (see p. 9f.); it also suggests a structure for national policy papers and a timeframe for the tasks.

As such, the statements in this briefing paper remains largely at a more general level, which have to be contextualized and adapted to local contexts and needs. In the following, we make some suggestions on the format and potential contents of the NPWs, then propose a structure for the National Policy papers that ought to result from the NPWs. We'd like to emphasize that these are suggestions that aim at securing coherence and a minimum level of comparability of the deliverables resulting from these activities. National partners are not only welcome but are actively encouraged to modify, complement and/or expand this briefing paper.

National Policy Workshops

The task for partners is to identify approximately **20-25 key-persons/policy makers** in their country, and invite them to a national policy workshop. The NPWs should take place in the regional/local setting of implementation of *mascil* and draw on resources (D2.1 National Working Papers on analysis of policy contexts and D2.2 Cross-National Analysis of the educational and policy context¹¹) and networks (for example people from the *mascil* National Advisory Boards) already existing.



The main aim of the national policy workshops is to foster cooperation and synergies among research, and practice fields, by producing strategies to support the widespread uptake of inquiry-based science teaching.

¹¹ Available in the project's website: <http://www/mascil-project.eu/reports-and-delivedables.html>

Definition of policy makers

For this purpose, **a wide definition of 'policy makers'** seems more useful that includes people in relevant high-level positions related to educational policy making and implementation at a national and regional level. This might include:

- Government representatives (central government ministries or regional/local where appropriate, e.g., Länder-level in DE or the UK; central in the NL);
- Regional administration personnel;
- Representatives from think tanks or foundations;
- Lobby and advocacy groups of various kinds (e.g., industry or employment associations);
- University personnel (e.g., teacher trainers);
- Trade unions;
- Parents Associations;
- Representatives from VET;
- Curriculum developers/designers;
- Head teachers;
- ...

To ensure participation in the workshop, partners may draw on their existing connections to stakeholders, for instance people from *mascil* National Advisory Boards (NAB), who may propose a list of relevant actors to be engaged.

Issues and topics for discussion

The partners and policy makers will discuss issues addressed in the policy document produced in the *National working papers* (Deliverable D 2.1) as well as in the *Cross-national report and policy paper* (Deliverable D 2.2). The exact content and issues to be addressed will vary from country to country –depending on the issues identified on the national report paper- but questions to be addressed in the national policy workshops might include:

- What obstacles for the national implementation of these guidelines do you see in national policy?
- How can these obstacles be overcome within the political area?
- What recommendations can you give to educational policy on a national level?

- How can policy and science cooperate to reach their common aim: a widespread implementation of inquiry-based science teaching?
- How can policy on a national /international level be involved?
- How can they support the project endeavour?

The results and insights of this process are documented in a National policy paper (see below).



*The **expected outcome of the discussion** during the national policy workshops revolves around the question: What can be done on national/international levels to motivate policy support the widespread implementation of inquiry-based science teaching in vocational contexts?*

Conclusions and recommendations from WP2 Cross-national report



*In this section, the **conclusions and recommendations** from the Cross-national report are replicated at length with the aim that partners comment and elaborate on how to transfer these more general recommendations to more concrete issues for discussion during the NPWs.*

The Cross-national report and Policy paper (Deliverable D.2.2) has yielded some more general conclusions and recommendations for policy makers. These are at a more general level and need to be contextualised to serve as a foundation for NPW discussions. These conclusions and recommendations are quoted and discussed in the following paragraphs:

“1st set of Recommendations to policy makers:

- The priorities that are evident in the national policy agendas are in line with wider European policy strategic aims, indicating a conducive [sic] context on which national policy practices can build on.
- There is a need for coherence in policy rhetoric between expectations of students’ learning and expectations of teachers’ training, which seems to be lacking at the moment. The proposed compatibility between policy envisions regarding the teaching of mathematics and sciences as evident in policy documents and policy orientations regarding teacher training, will be a step towards bridging the gap between what is envisioned in theory and what is implemented in practice. [...]” (D.2.2, p.37)

“2nd set of Recommendations to policy makers:

- Inquiry based learning seems to be prioritized more in primary and general secondary than in vocational education. Policy makers should consider the potential of the methodology in vocational contexts, and make more effort in promoting inquiry based learning in vocational contexts.
- In countries with a tradition on implementing activities relating to inquiry based learning, policy orientations seem to move towards more content based curriculum objectives and emphasis on content knowledge; discussions among policy makers in different countries would benefit the re-consideration and the negotiation of major strategic aims in education in each country for further improvement.
- School cultures are resistant to change. Careful and in-depth analysis of different parameters pertaining to school culture will benefit the successful accomplishment of policy envisions in relation to inquiry based methodology to school practice.
- There is a need to value the learning of inquiry process in schools by identifying and including the assessment of these processes in national assessments.
- There is a need to support the development of educational materials and teaching methods to help teachers in enriching their repertoire towards inquiry based learning.
- There seem to be a reluctance to implement inquiry classroom activities not only from the part of teachers but also from parents. For the successful implementation of inquiry based learning teacher professional development should be accompanied with the actual engagement of parents. [...]” (D.2.2, p.38f.)

“3rd set of Recommendations to policy makers:

- The connections between schooling and the world of work seems to be prioritized at a level of a general rhetoric in some counties without concrete action plans, especially in primary and general secondary education. Policy makers should further consider the potential of such a connection, in the view of enhancing employability.
- The rethinking and redefining of the concept of the “world of work” is the basis or an appropriate preparation of pupils for the career entry. Strengthening the connections and cooperation between general and vocational education would enable the exchange of good practices and expertise.
- There is a need to value the connections between schooling and world of work by identifying and including it in the national curriculum.
- There is a need to support the development of educational materials and teaching methods to help teachers in enriching their repertoire towards making connections between schooling and the world of work.
- Vocational schools should be supported in integrating further work in their school activities (for example visits to workplaces, development of teaching materials, practicum, and visits of experts to schools). [...]” (D.2.2, p. 40)

“4th set of Recommendations to policy makers:

- Well educated teachers are the foundation of any system of formal science, mathematics and technology education. Systems to ensure the professional development of teachers should be a national policy priority, and a coherent national policy orientation of training initiatives should be evident and prioritized.
- Transforming teacher practice should be a long-term project, requiring significant and sustained investment in continuous professional development. Short-term cycles of training initiatives have proven to be unsustainable and of little effect in transforming classroom practice. [...]” (D.2.2, p. 41)

“5th set of Recommendations to policy makers:

- Concrete guidelines or measures on how equity, low-achievement and entrepreneurship issues are to be addressed in science and mathematics education are needed. Important to this respect is the consideration on how specific teaching methodologies (such as inquiry based learning) may be a lever towards the accomplishment of such aims.
- There is a need to support teachers through effective pre-service and in-service teacher training and appropriate materials so as to transform classrooms in a way that equity, low-achievement and entrepreneurship issues are matters of day-to-day practice. [...]” (D.2.2, p. 42)

Together with the National Report summaries and recommendations (see D.2.2, appendix 2, p. 68ff.) these recommendations

National policy papers (resulting from the national policy workshops)



After the NPWs, partners need to document the NPWs, analyse the discussions and synthesise the themes and issues raised as well as present the solutions and recommendations proposed by participants.

*As such, **the content of the NPPs** revolves around the question as to what can be done on national/international level to motivate policy to support the widespread implementation of IBST.*

Suggested structure for National policy papers

1. Introduction (ca. 1 page)

- 1.1 Overview of work package 2 (→ and role of national policy paper in it)
- 1.2 Summary of national policy paper
2. Approach and Methodology (ca. 1,5 pages)
 - 2.1 Rationale for selection of policy makers
 - 2.2 Rationale for selection of specific issues for discussion
 - 2.2 Implementation of national policy workshops
 - 2.3 Problems/issues arisen during the implementation
3. Documentation of workshop (ca. 2-3 pages)
 - 3.1 Setting and Context of NPW
 - 3.2 Themes and issues discussed
 - 3.3 recommendations
5. Summary and Conclusion (2 pages)

Time Frame

Task	Period or Deadline	Responsibility
National teams to inform WP2 leader of their national workshop-planning schedule Contact: Fotini Chaimala haimala@iacm.forth.gr	December , 2014 (Month 24)	All national teams
Selection of participants, statement of rationale for inclusion – important issues to be addressed in the policy workshops in each country, synergy with national policy papers	January , 2015 (Month 25)	All national teams
Review and feedback given to national teams	January , 2015 (Month 25)	WP2 leader – Kathy Kikis-Papadakis
National teams prepare the materials for their workshops and send WP2 leader workshop folder Contact: Fotini Chaimala haimala@iacm.forth.gr	February , 2015 (Month 26)	All national teams
Review and feedback given to national teams	February , 2015 (Month 25)	WP2 leader – Kathy Kikis-Papadakis
Workshop implementation and documentation	March, 2015 (Month 27)	All national teams
First draft national policy paper sent to WP2 leader Contact: Fotini Chaimala haimala@iacm.forth.gr	May, 2015 (Month 29)	All national teams
Review and feedback given to national teams	May – June 2015 (Month 29-30)	WP2 leader
Final national policy paper	June 2015 Month 30	All national teams

Preparing for Structuring and Implementation of the National Policy Workshops

Reading materials

D2.1 National reports on analysis of policy contexts – focus on each partner national context

D2.2 Cross-national report policy paper – focus on conclusions and recommendations

Issues for thinking

- Which are the main target groups for participating in the policy workshops in your country? How would you engage them in participating?
- Which are the main issues/themes for discussion in the workshops and what is the synergy with main outcomes of the policy paper provided by your country?
- Which are the main challenges that you view in the process of implementing your national policy workshop?

Things to do before the project meeting in Essen



Please prepare a poster with the concept of the national implementation of the policy workshop (with the aid of the attached indicative template) – ideas, purpose, target group, main topics/message, challenges.

The poster will be used in the session “Policy workshop (WP2)” in the Essen meeting (Gallery walk: all countries will present their current ideas, plans or open questions with regard to the implementation of the policy workshop in their country . Country groups will visualize plans/ideas/formats on the posters and the countries will exchange ideas.)

