

Long-term activities for innovations in initial teacher education Deliverable 8.2

Each scientific partner in the “KeyCoMath” consortium regularly offers courses in initial teacher education for students to acquaint them with didactic concepts. In the following, the results of the project “KeyCoMath” will be examined. University students will study didactic theories and pedagogical methodologies to develop key competences by mathematics education that have been developed and tested in “KeyCoMath”. University students therefore create learning environments by themselves and learn how to organize mathematics lessons to enhance pupils’ active, self-responsible, and exploratory learning.

Moreover, these “KeyCoMath” partners are members of the international scientific community and will spread out the results of the project among scientists and teacher educators. Thus, a long-lasting substantial impact on initial teacher education is foreseeable. This scientific paper describes the activities of each project partner implementing “KeyCoMath” in initial teacher education in long term, even though not all activities of the partners in this field in the next years can be predicted.

University of Bayreuth (DE)

The everyday work of the members of the Chair of Mathematics and Mathematics Teaching Methodology at the University of Bayreuth is initial teacher education.

- (1) Thus, it is easy to implement didactic concepts for supporting key competences in initial teacher education courses (lectures and seminars) at the university – even after the project “KeyCoMath”. In each term at least five didactic seminars and three lectures are being offered with 150 students of mathematical teaching taking part.
- (2) During their studies, a practical school training is required. There, university students gain their first teaching experiences and are supported by an accompanying seminar at the university.
- (3) The Chair of Mathematics and Mathematics Teaching Methodology encourages Bachelor, Master and PhD theses in the field of developing key competences. This is a good opportunity to achieve long-term effects and to be able to continue this research beyond the end of “KeyCoMath”.

Recent titles are e.g. *Developing key competences by the usage of tablet PCs in mathematics education*, *Good Mathematics Lessons in Secondary School – Indicators of Quality from Theory and Practical Experience*.

Bulgarian Academy of Sciences (BG)

The Institute of Mathematics and Informatics of the Bulgarian Academy of Sciences (IMI-BAS) is a national organization for research and applications in the field of mathematics and informatics (including research and applications in education in these fields).

- (4) It is among others involved in the supervision of PhD students, the supervision of individual projects of university students (diploma works) and of secondary school students. In all Bulgarian Universities that offer initial teacher education, courses (optional or obligatory) on the development of key competences by mathematics education will be introduced. The “KeyCoMath” team of the Bulgarian Academy of Sciences will coordinate these courses and update the content. For this, the didactic concepts and the teaching and learning material developed in “KeyCoMath” will be utilized.

University of South Bohemia (CZ)

The Faculty of Education of the University of South Bohemia has more than 3500 students. It is among others involved in pre-service education for kindergarten, primary and secondary teachers including PHD studies in the theory of mathematics education.

- (5) One special part of the teacher education at the University of South Bohemia is composed of compulsory practical phases in schools, where students turn theory into practice.
- (6) University courses impart project knowledge: The didactic lab, which is equipped with multi-touch and three-dimensional models for students at university and in-service teacher education, was established. It is used especially in didactics of mathematics.

Mathematical exposition of 2D and 3D geometric models and tools made by students to support mathematics education at Faculty of education is created. There are seminars aimed at the following issues: What to create and how to use it in math lessons?

In seminars, attractive examples from daily life are approached. Students should operate useful mathematics and experience for themselves what problem solving, communicative, digital, and professional learning competencies really mean. These examples are set in the context of the Bloom taxonomy. Only if they experience didactical and methodical concepts of “KeyCoMath” in these seminars from the learner's perspective, they can learn to implement them in their own lessons.

- (7) Under the direction of members of the Faculty of Education, university students regularly organize mathematical camps for pupils. During their holidays, pupils can take part in mathematical activities like geocaching, puzzling, paper folding etc. All of these activities are planned and supervised by university students. On the one hand, this is a good possibility for students to stay in contact with pupils and to get an impression of pupil's way of working and thinking. On the other hand, university students get the chance to try themselves out as learning guides and to test their self-prepared learning materials.
- (8) The following new activity fits in this context: As long-term activity of “KeyCoMath”, the Faculty of Education will introduce optional mathematical seminars at schools. These seminars will be offered for weaker and stronger pupils and will be organized by university teacher students, who are closer to the pupils and who try to popularize mathematics in school.

- (9) The University of South Bohemia regularly organizes company visits for its students to grant them insight in mathematical and technical disciplines.
- (10) University students should have a stronger commitment to projects lead by the department of mathematics. For instance organizing mathematical camps where university students take care of selected pupils interested in maths (solving problems, mathematical competitions, didactical games).

University of Bergen (NO)

The Department of Mathematics at the University of Bergen (UiB) offers the following types of teacher education:

- i) An integrated program, where students aim to take a degree qualifying them to teach two subjects.
 - ii) A postgraduate certificate in education building upon a Bachelor (for primary and lower secondary school teachers) or a Master degree (for upper secondary school teachers) in two subjects.
 - iii) A Master degree in mathematics education. The target group consists of experienced secondary school teachers in mathematics.
- (11) In all the three programs, development of key competences is based on the results of “KeyCoMath”. For instance a lecture on the content of “KeyCoMath”: 13. Nov 2014 MAUMAT647 ‘Aktiv problemløsning I matematik’ (*Active problem solving in mathematics*’).
 - (12) An article about “KeyCoMath” has been published in the journal “Tangenten”, which is a national, Norwegian place for dissemination and discussion of ideas and research in mathematics education and which is often used in courses for initial teacher education, also at other universities and university colleges in Norway. - Andresen, M. (2015). Glimt af kreativitet i problemløsning. (Glimpses of creativity in problem solving). In *Tangenten* 2/2015 (ISSN 0802-8192) 6 pages (In Norwegian) (Even after the end of “KeyCoMath”, papers will be published and results will be presented. These findings will be topics in future seminars.) The University of Bergen has established and formed a network based on the schools where the students’ practical school training takes place under the supervision of teachers. The participants in the network are teachers of mathematics. They offer seminars at the university with talks and workshops. One talk (29th October 2014) at a seminar in the network was about the local part of “KeyCoMath”. The network will continue to study and discuss the results of the project.

University of Cyprus (CY)

The mission of the Department of Education of the University of Cyprus is to campaign for the promotion of educational sciences and to prepare educators for all levels of the educational system. This means that this project partner is deeply involved in initial teacher education.

- (13) The university course for pre-service teachers’ education (BA) called “Didactic of Mathematics” has already been and will further be reorganized with the use of ideas from the project. The same will be done for the courses for the specialization topic of mathematics for BA in education like “Didactics of Mathematics (II)”, “Use of technology in mathematics education”, “Special topics in mathematics education”.

- (14) Even post graduate courses such as “Mathematics curricular and evaluation”, “Mathematical Problem Solving” or “Theories in Mathematics Education” still contain the results of “KeyCoMath”.

University of Klagenfurt (AT)

The Institute of Instructional and School Development (IUS) of the University of Klagenfurt is an Austrian Educational Competence Centre. Its field of operation is the development of and research on educational practice, schools and educational systems. It incorporates the derived insights in teaching and counselling. A key issue is the interrelation between research and teacher education.

The Institute of Instructional and School Development is open for different scientific paradigms. In addition to classical qualitative and quantitative research, it fosters action research. The discussion about internal and external points of view is regarded as a basic presupposition for learning in social systems. Accordingly, great importance is attached to an open dialogue between academic research, school authorities and practitioners.

Long-term activities for initial teacher education will support university students’ experiences concerning didactic theories and pedagogical methodologies to develop key competences.

- (15) Several seminars (the so-called orientation practica) aim at supporting pre-service teachers during their very first year of study in planning and implementing teaching episodes in mathematics classrooms. Here, the focus on key competences is inherently important.
- (16) The same is true for the following practice phases, which are part of pre-service teachers’ later studies: teachers are obliged to plan, teach and evaluate even more lessons, the longer their study is running.
- (17) More examples: Seminars like “interdisciplinary mathematics”, or seminars on Fermi tasks are particularly relevant when addressing key competences.
- (18) Further seminars for initial teacher education (e.g., focusing on “action research”, “school quality” or “peer coaching” will be adapted to include the concept of key competences.
- (19) Pre-service teachers have to write a master thesis at the end of their university studies; many of them deal (at least implicitly) with key competences.
- (20) Moreover, new curricula for initial teacher education are currently developed in Austria; these developments are highly suited to include the ideas of key competences.

German Department of Education in South Tyrol

The initial teacher education is organized by the Faculty of Education of the Free University of Bolzano and is therefore not a specific responsibility of the School Authority.

- (21) Nevertheless, Inspector Marta Herbst cooperates as representative of the School Authority with the Faculty of Education to collaborate in conceptually designing the initial teacher education.

Rottenschwil School (CH)

The Rottenschwil School is a state school comprising a kindergarten (for 5- to 6-year-old children) and a primary school (for 7- to 12-year-old children). The school practices the pedagogical concept of inclusion. Children of different levels and ages learn together collaboratively in classes. Rottenschwil School has several cooperation projects with scientific institutions and is involved in different scientific studies. Some teachers at Rottenschwil School additionally work in initial teacher education and at universities.

- (22) The Swiss project partners distribute the results and the experiences of their activities in Switzerland especially among concrete and best-practice examples in a series of publications. These scientific reports find their way into initial teacher education at Universities of Education, whereby seminars and lectures include didactic results of “KeyCoMath”.
- (23) At Rottenschwil School, concepts for supporting key competences and their practical implementation are emphasized in practical courses for teacher students.
- (24) Conferences on project results with special focus on “Dialogical learning”, different ways of assessment and inclusive education are held regularly. Not only scientists or teachers, but also university students are kindly invited to participate.

Most of the partners of the “KeyCoMath” consortium are intensively engaged in initial teacher education. They will use, disseminate and implement the results of “KeyCoMath” in their future works.

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