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Facilitating stakeholders: Experiences from the Austrian IMST project

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Abstract: *In this paper, we will present an elaborate example of what can happen, if you give educational stakeholders a chance to participate and even more instigate change processes in a supportive environment. We report on experiences from the Austrian IMST (Innovations Make Schools Top) project.*

Key words: Professional development of teachers; teacher projects; teacher institutes; action research; Austria

Introduction

Many educational systems face the same challenge: Years of research have led to good notions of what might work in a classroom, and even better notions of what does not work. Pilot studies have found promising ways to teach, but those were never taken up large scale and often disappeared once the project in which the teaching methods were explored terminated.

This problem is in itself well known, and moved the field of educational research to engage in organizational studies and consider not only professional teacher development, but its embedding in school and system development. This shift also instigated a shift in the perception of the involved teachers: no longer are they seen as individuals who put what researchers have thought about into practice, but they are seen for what they are: Autonomous subjects, who can drive changes or object to them and hinder them for reasons which may be good or bad depending on their local knowledge and their motivation. Konrad Krainer (this volume) has written on this shift and the resulting perception of teachers as stakeholders.

In this paper, we will present an elaborate example of what can happen, if you give educational stakeholders a chance to participate and even more instigate change processes in a supportive environment. We will also present this environment, the measures taken and needed to support people in following their vision, and in grounding that vision in research. The narrative of this development is a historical one, starting with the “national educational crisis” introduced by the perceived poor performance of Austrian students in the 1995 TIMS study.

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The educational context and the overall conception of IMST

In 1995 Austria took part in the TIMS-study. The results of the high-school seniors were considered poor, and the ministry of education commissioned an analysis of the state of mathematics and science education in Austria. Main findings were that there exist(ed) many promising projects and initiatives, but they were fragmented and not well known (see Krainer, 2003). Thus, many initiatives had to start from scratch, instead of learning from each other and previous dead-ends. There was also a lack of supportive institutions, no professor for didactics of mathematics for elementary schools and also a lack of professors for didactics of the physical sciences. Additionally, one wanted more teachers engaged in reflecting and working on their teaching.

The strategy to rectify that situation was therefore to install a project – the IMST project (“Innovations Make Schools Top”²) – to support teachers with the main tasks to network teachers working on their teaching, as well as to network projects, developments etc., to raise the number of teachers engaged in a reflection of their teaching, and to support those teachers. Thus, the project had two strands : a) a networking strand, which tried to involve teachers and the educational authorities in a region to implement networking and professional development activities in their region, and b) a teacher project strand organized in the form of a fund (the IMST-fund), which supported between 100 and 150 teams of teachers³ to conduct action research projects on an aspect of their own classroom teaching. Additionally, the IMST-team was commissioned to map out a support system for the quality development of mathematics, science and technology teaching.⁴

IMST started in 2000, since then the project was re-commissioned several times (so far till 2012). The project went through various phases: At first, there was a stronger direct involvement of subject didacticians, who themselves worked with teachers alongside expert teachers. Later on, the expert teachers working with the didacticians worked with the teachers by themselves. Over the years the range of addressed teachers was increased: the project started initially to support higher secondary schools only (because of the bad results at the TIMSS upper secondary); after four years lower secondary teachers were also addressed, and finally in 2007 the call for participation was opened for elementary school and kindergarten teachers. In 2010 IMST started to participate in the EU-project Fibonacci, participating in an international exchange on models and strategies of “scaling up” projects to effect system change.⁵ The increase of the target population posed some challenges: Since higher track secondary education is taught at the universities as opposed to the university colleges of teacher education, the subject didacticians were experts for the higher track secondary schools, but had on average little expertise for e.g. elementary school didactics. And for a long time, university colleges for teacher education did not have a requirement for their staff

² (The former name was “Innovations in Mathematics, Science and Technology Teaching”, however, when the subject German language was integrated the project title needed to be renamed to a more encompassing one)

³ The number varies due to the number of submitted project proposals and the project budget. In 2010 the ministry decreased the budget leading to a reduction of supported projects to 100. About another 20 projects were financed by an economic fund.

⁴ A more detailed account of the development of IMST can be found in Krainer (2008)

⁵ This is only one aspect of Fibonacci; in general Fibonacci fosters inquiry based mathematics and sciences education in Europe; scaling-up local initiatives is one important aspect. See www.fibonacci-project.eu.

to be engaged in research (This changed in 2007⁶). Over time, the fund strand developed and revised guidelines of how to support the teachers engaged in the action research projects. A systematic approach to evaluating the project and additional research projects contributed to a growing understanding on the effects of the project and the needs for further development (See Krainer, Hanfstingl, Zehetmeier; 2009; Rauch, Kreis, 2007).

Also, at the beginning there was no regional network structure for mathematics and the sciences in the Austrian provinces. Initially, the team worked with a number of highly engaged schools. Later on, teachers of those schools formed the seed of the developing regional networks.

But all this structure to support teachers and schools is futile, if teachers and other educational stakeholders do not reach out to make use of it to their own ends.

Teacher projects in IMST

One strand of IMST set up a fund to support action research projects done by teachers or teams of teachers. Usually around April a call for application went out to all Austrian schools, asking them to submit project proposals in the fields of mathematics, the sciences and German (mother tongue) classes. The project proposals had to be submitted on-line. Over the years, the IMST-team had put together a detailed questionnaire for the proposal, in which many aspects of the intended project were queried. For instance, it asked about the aims, the classes and projected number of students (split by girls and boys), the number of participating teachers, the intended evaluation, the material needed to purchase etc. Teachers could ask for a budget including support by experts of their choice (the budget requests were carefully screened for their fit with the project and had to be approved of by the IMST team). The information was put in a data-base and used as a guideline to determine the suitability of the project for funding by a team of external evaluators. Since the number of supported project was restricted to a number between 100 and 150 (depending on the national funding), not all suitable applications could be supported. Each year, the external evaluators had to resolve the tension between excellence and supporting learning experiences. Not in all cases the project was already well projected. Concerning projects which seemed interesting in their enterprise for developing new approaches in teaching and learning but lacking in their description, the stance was, that there were people willing to try with a lack of experience of either thinking or of reflecting and writing about their teaching situation and goals. The expectation was that people were aware of the requirements of the project (see below) and that they would acquire some of the lacking competencies in the workshops and through the engagement with the project and the community of other teachers pursuing their projects.

Besides requiring the project application detailing a plan of activities and an evaluation, IMST required teachers to participate in a start-up workshop (usually in the second month of the school year) and additional workshops in which they refined their project plans. These ideas were usually written down and then commented on by the advising IMST teachers, and jointly

⁶ Strictly speaking, the university colleges for teacher education were only installed in 2007, their predecessors were in each region two institutions: the pedagogical academies responsible for initial teacher education and the pedagogical institutes responsible for continuing professional development.

discussed in the workshops. Teachers could sign up for evaluation workshops which introduced basic ideas about evaluation and left room to discuss how to evaluate their specific project with the workshop leaders (staff of the university). IMST also required teachers to submit a project report at the end – this was again commented on and frequently revisions were required, sometimes teachers attended “writing workshops” in April or May to that end. The approved project documentation was then published online (www.imst.ac.at/wiki⁷).

Synergy with a specific support system

That not all children are well served by their schools is a well-known fact leading to additional services of special education in various forms. For Austria, Lorenz and Radatz (1993) found that 6% of elementary students show signs of dyscalculia; another 15% are poor in their mathematics performance and need additional support. PISA 2003 found that 19% of the 15-year olds are at risk in mathematics. In the province of Carinthia in Austria, the national authorities first supported a project and later on installed the special education center “Sonderpädagogisches Zentrum” (SPZ) to support teachers in working with children with special needs in elementary schools, in particular with children with dyslexia and dyscalculia. Teachers working as special education teachers were regular elementary school teachers who got additional education on the state of the art of dyslexia and dyscalculia by federal institutions.

In the province of Carinthia, the government sponsored either one or two special education teachers for each of the ten districts. These teachers had to be asked for by the elementary school teachers, they then came to school and worked for up to one and a half year individually with a child in the afternoon after regular school hours. In addition, they should also advice teachers on dyslexia and dyscalculia.

One of these teachers, responsible for supporting schools and teachers with students with needs is Angelika. The work as a special education teacher being called in, when the regular classroom teacher noted something was off, was unsatisfying to her⁸. Given her background as a former regular classroom teacher together with the new insights provided by the further education on dyscalculia, she found that generally she was called in too late – in third and fourth grade, after an unhelpful number concept had already been acquired. Given her background, she was also convinced that part of the problems could have been avoided by a different teaching approach. After all, international comparison and brain studies suggest that only about 6% of the students may face dyscalculia due to their neurological basis, but that the additional 15% could be avoided by another way of introducing mathematics in elementary school. In other words, while many students might not face problems due to an erroneous number conception later on, a small(er) percentage of students would remain, for whom mathematics would be challenging. But even for those, the experience of mathematics could be less upsetting, or even interesting and positively challenging.

Since part of the duties of a special education teacher involved supporting and consulting teachers, it was not a far stretch to develop a seminar for teachers informing them about new

⁷ The reports of the work of the teachers and of Angelika cited in this article can all be found in the IMST wiki.

⁸ The second author of this article. All teacher names used in this article were changed.

insights in those areas. In 2007, Angelika offered seminars (4 units each) on “Avoiding dyslexia” and another series of seminars on “Avoiding dyscalculia”. After one of these seminars, a participant – Gabriele – came up to her. Gabriele was about to apply for an IMST project, and asked whether the special education teacher could coach her changing her classroom teaching in accordance with the “new approach” in this project. In other words, Gabriele was aware of the IMST project, about to submit a project proposal, and attending the seminar, she found a topic she wanted to pursue, something specific she wanted to change in her classroom and in her mathematics teaching.

Gabriele and Angelika: Their first IMST project

In 2007, Gabriele submitted an application, in order to work with Angelika on her first grade teaching of mathematics and reading (see Zoltan, 2008). IMST approved the project and accepted the budget request for an expert support. Additionally, Angelika’s supervisor at the special education center supported her ultimate intension to prevent or decrease the rate of dyscalculia and dyslexia appearing in the district’s classrooms. She sanctioned Angelika to use one hour a week to accompany the project even though another special education teacher was assigned to the very school Gabriele was working in.

At the same time, as Gabriele pursued an IMST project, a colleague at her school, Otelia, also engaged in an IMST project about experiments in science teaching in her elementary class; both teachers attended the IMST workshops and learnt about each other’s projects. Thus, in the end, four people started to discuss their projects at the school site: the two teachers of the school (Otelia and Gabriele) and the two support teachers of the special education center (Angelika and another special educator).

Gabriele’s project afforded Angelika a chance to work with an engaged teacher to put her ideas into practice. Angelika had been working as an elementary teacher before, but now she needed to coach someone else to implement the changes she regarded as beneficial. In the seminars during the previous school year, Angelika had been teaching Gabriele about dyslexia and dyscalculia and she had distributed further materials on those topics. Additionally, Gabriele had already experience of working with Montessori materials. However, with Angelika she now introduced “learning plans” similar to the Dalton plan as developed by Helen Parkhurst (1922) into her classroom. Learning plans were plans for six to eight weeks of subject learning, detailing the concepts students should acquire, accompanied by materials, work sheets, tasks etc., which students would work on. During this time, students should explore and acquire central concepts, not just practice something which was previous presented by the teacher. Thus, a central tenet of this form of instruction is to strengthen student autonomy, making them from an early age onward responsible for their own learning.

Two units each day were devoted to students working on their plan work. During that time, students would work individually or in pairs on self-selected tasks with the teacher helping or observing individual students. Students were not required to do all and every task, but some tasks should be mastered by all at the end of the six to eight weeks (minimal standards). An important element of teaching with needs of students with difficulties typical for dyscalculia and dyslexia in mind was to support them but also all other students with carefully selected

tasks and questions, specific contrasts etc. This should enable them to quickly find an efficient mathematical strategy and the relevant mathematical concerns, leading the children to discover mathematical patterns they can exploit to their advantage. For instance using sets like in Table 1.

Table 1.

Calculate:

6-1	7-2	8-3	9-4
6-5	7-5	8-5	9-5

It is important specifically for students with difficulties to support them not to lose possibly limited resources of attention and memory on side-tracks. Here, the teacher may actively intervene with guiding questions.

In weekly meetings, Angelika and Gabriele planned the learning environment; they discussed the goals of the units and devised the learning plans. They discussed their classroom observations and individual further support for or needs of specific students. In her IMST report (Kittner, 2009), Angelika observes that during the school-year the teacher decreased in providing information to student queries and began more and more to guide students' own thinking, for example, by posing relevant questions.

Gabriele comments in her report (Zoltan, 2008), that in an individual assessment she did with the students at the end of the school year none of the students made mistakes due to false concepts or inappropriate strategies. She also notes that students differed widely in their competencies, e.g. one student with learning difficulties (as well as with a general delayed development including motor development) took a long time to master some of the concepts.

At the end of the school year, Gabriele had started to radically change her teaching, giving more and more space to her students. She was very satisfied with her new classroom teaching and decided to continue the project the following year in second grade with another IMST project (see Zoltan, 2009). With enthusiasm she inspired other teachers both at her school and at another school also to change their classroom teaching along the same lines.

Angelika had acquired many insights about supporting changes in classroom teaching. For her, the experience validated her beliefs that she should support teachers to integrate insights from dyslexia and dyscalculia into their classroom teaching rather than support them in dealing with problems partly raised from other teaching approaches. At the same time, the individualized learning setting allowed her and the classroom teachers to better support those students who do have (by reasons stemming from other sources than schooling, e.g. neurological differences) more difficulties in mastering those core competencies than other students. She also got convinced that it was important that on top of the seminars she had offered, she (or someone else) would aid the teachers in their change process for first and second teaching. She presented her ideas and the results of this first project to her supervisor and the district's superintendent. When eight teachers asked her to support them during the following year, her supervisor and the district's superintendent endorsed her efforts: she was

granted to use two hours a week for assisting those teachers. Based on this newly won time resource, Angelika installed a monthly quality assurance circle.

The second year: IMST and EVEU

In the following year, five of the eight teachers (of five different schools) participated in IMST working on their classroom teaching. Angelika herself also submitted an IMST project, a so called “Verbundprojekt” (roughly translated: “compound project”). This is a special form of project, IMST institutionalized in order to facilitate collaborative endeavors like this. A “Verbundprojekt” requires a number of project devoted to the same issue, and a further project, which works with all of them, for instance in doing an overarching evaluation, organizing targeted professional development (and documenting and evaluating those efforts as required by any IMST project). Angelika called her Verbundprojekt “EVEU” (Ein veränderter Elementarunterricht – a changed way of instruction in elementary school; Kittner 2009, 2010).

In other words, during the second year, eight elementary school teachers participated in the quality assurance circle, and five of those teachers did an IMST project, working on some aspect of their teaching, evaluating and documenting it. Angelika facilitated the circle. On top of that, given her duty as special education teacher for the district, she could use one of her weekly support hours to aid two of the teachers at Gabriele’s school. She used that time to prepare and discuss materials for the classroom teaching, model the “new” teaching approach, help the teachers to organize the classroom into the new learning environment, to observe the students and teachers and to provide feedback. She also used her time teaching students to allow the classroom teacher to go off and observe another member of the quality assurance circle teaching what they had previously discussed.

The participation of the teachers in the quality assurance circle was voluntary with no compensation, for instance by a reduction of their professional development requirements. The meetings were carefully planned, usually the group decided on a specific topic to address during the following meeting. Angelika took care, that the group remained on task, and used the time in a constructive way. Mostly they worked on making themselves ready for the next learning stage according to the level of difficulty and complexity determined by research on dyscalculia and dyslexia. They prepared materials and tasks, and were greatly aided by the materials already trailed by Gabriele during the previous year. They also discussed their experiences in using the materials, and reflected on what had worked and what did not. The last meeting was devoted to assess the competencies of the students to reflect on what they had learned and also to prepare the stage for the next year. In their project documentation, teachers stressed how important the group was for them “Without the other teachers’ help, we would have been too much on our own. [...] Just the fact that one was talking about the problems appearing over the course of the school year provided some measure of relief and motivated to go on. Often one found a solution in such conversations.” (Zoltan & Thurner, 2009: 14)

The meetings took place in a room specifically organized for these meetings at a local elementary school. In the room Angelika displayed materials, demonstrated how to set up a “learning path” for the students and presented literature.

Gabriele and her classroom was an important agent in that development. She told of her own practices and shared her problems and solutions. Two first grade teachers of her school followed her example (in their own way), being able to build on her experiences.

Parallel to the work with the teachers, Angelika still offered seminars to teachers on avoiding dyscalculia and dyslexia which were well attended showing a need of the teachers. Given her experiences and further feedback of participating teachers, Angelika decided to turn the seminar in a series of four and later five modules, allowing her to go more deeply into the topics and addressing concretely of how to put the insights into dyslexia and dyscalculia into classroom practice.

Further developments

The series of seminars led again to teachers asking Angelika to coach them in putting changes into practice. The following year, she had 12 teachers of various schools participate in another quality assurance circle. The participation in such a circle was accredited as official professional development, counting as fulfilling the elementary teachers’ in-service education requirement.

In 2011, Angelika was coaching three quality assurance circles in her district, and had queries for support from teachers of other districts. Angelika is now in the process of expanding her model to other districts, and to widen the support in her district. She feels that those teachers, who participated in the model, implemented and reflected the changes in their own classroom and took part in the quality assurance circles, could now themselves advise other teachers in particular in their own schools, to implement further changes. At the same time, she strives for the educational authorities responsible for the districts to have their special education teacher also support quality assurance circles, as she deems an ongoing support and reflection of changing classroom practices paramount to any sustainable change.

In 2010 Angelika’s EVEU project won the IMST award⁹ in the special category for projects involving a number of classes or schools, in 2008 Gabriele’s project had won the classroom project award. In each case, the minister of education herself congratulated the winning teams.

Discussion

What made these developments possible? What are the lessons learnt from that development? Let us briefly consider the circumstances that enabled Angelika and Gabriele to go from dissatisfaction with the status-quo to a new practice of teaching and learning and of

⁹ Since 2007 the IMST-award awards three of the IMST projects in each of the two categories mentioned above for outstanding excellence. A jury evaluates each project on a number of criteria including the innovative character, attention to making the subject attractive to students, dissemination, sustainability, consideration of gender issues and careful evaluation.

professional development. The following points (but the first one, which integrates aspects of all three) are organized in line with Krainer's (this volume) three dimensions of aspects important for teachers' learning: Context, Community and Content.

- (a) A number of highly dedicated teachers were engaged in these efforts, in particular during the first two years. However, the seminar attendance showed a high need and a willing of teachers to take advantage of anything worthwhile, even if it takes time and effort. Some teachers of the second year stressed in their reports that it was important that there were materials already out there, they could take away, that they did not have to develop everything from scratch. The situation was different during the first year; here Gabriele and Angelika had much less to build on. Thus, in the beginning, the project needed a few highly dedicated hard workers, who developed the materials, and put them into practice. Yet, given research on innovations (Everett, 1965) it is to be expected that some teachers will be willing to take the first steps. It is more difficult to get more people to participate, however, as in the presented development the work-load decreases with the number of experienced teachers who are willing to share their experience and materials, the prospects are positive.

Context

- (b) In all cases, the principals and supervisors were very supportive, not only allowing the teachers to take time to participate in continuing development but being actively encouraging. This stresses the importance of the leadership of principals as put forward by Krainz-Dürr (1999, 2006).
- (c) Likewise the educational authorities were very supportive with time granted to work on the project and active financial support for materials etc. We find that – at least in Austria – the educational authorities are usually interested in effecting (positive) change as long as it is relatively cost neutral. In the presented case, the predominant cost factor was the time Angelika spent in various classrooms and in supporting teachers. This was within the scope of her work requirements, even though it meant a re-framing of her task from addressing determined problems to preventing problems (as far as possible).

Community

- (d) While the developments needed dedicated practitioners in a supportive environment, Angelika also considers IMST as pivotal in the developments. With IMST, the teachers working with Angelika pursued their own projects, according to the funding philosophy. This implies that while the teachers worked with Angelika, they were nevertheless in charge of their project and their classroom development. IMST did not require them to consult this (or any other) expert, and to work with him or her. In other words, the environment of IMST places Angelika and the teachers as equal partners, and left – with respect to the documented project – the teachers in authority. The teachers were responsible for their projects and had to write their reports. Even though Angelika had a clear vision of what she wanted to achieve, IMST held the teachers responsible for their own projects, and discussed their projects and their documentation directly with them.

- (e) At the same time, IMST served in the capacity of a quality assurance institution – asking for a project plan, a budget plan, requiring evaluation and documentation. However, IMST did not direct the way the project went or ask for particular topical considerations. IMST expert teachers advising the project may have offered suggestions, and may have provided further literature and thoughts, asking teachers for reflection on some topics. But they would not require them to pursue an active (instead of reflective) role in following up one of their suggestions.
- (f) Through IMST and in particular the workshops, teachers met other people engaged in projects; in the particular case two teachers at the same school working on different ideas started to discuss their ideas in (and out of) the workshops. The common task of “project management” in a shared framework of requirements (and accounting) afforded a joint interest and supported the development of a continual exchange.
- (g) Angelika’s work placed her in a singular context – as a special education teacher working for the district she was well educated. To uphold the quality of her work, she was and needed to be in constant contact with the institute for learning difficulties in mathematics providing her with up to date information and literature. She as an expert needed an expert institution, a community of experts, to turn to herself.

Content

- (h) An important element of IMST is the requirement of writing up a project report. For many teachers this is a difficult task (see also Schuster 2008). However, in the end the “Verbundprojekt” EVEU could draw on six teacher reports and the report of Angelika herself. This provided a further basis for presenting the project to interested parties like the educational authorities, Angelika’s supervisor etc. and to elicit further support. Few teachers and other educational personnel have experiences in writing up their insights and ideas. IMST also provides a support structure for writing reports and reflective discourse on instruction. Teachers may attend writing workshops, submit various drafts and get feedback; they learn how to present themselves and their ideas. We think that this is an often underestimated aspect of classroom change: (effective) classroom practices needs to be communicated to spread and communicated well and not only verbally. IMST afforded the teachers and Angelika to work on the presentation of their ideas to be suitable to be convincing others.
- (i) Content-wise the project offered an up-to-date approach to teaching mathematics and reading skills for elementary school teachers. This enabled teachers to teach and students to learn two core subjects of elementary school in a consistent way. Since this article is addressed foremost to the mathematics education community, we want to stress that it is questionable whether students’ active participation in their learning of number concepts would work as well, if they encountered a different participatory positioning in their language classes. If we want to effect changes in elementary classroom, we believe we need to integrate the subjects with respect to didactical stances.

In brief, there are many factors and elements which enabled EVEU to grow. But EVEU is not the only project started by teachers and dedicated educational support personnel that expanded to something larger (see Hanfstingl, Krainer, 2008, Schwetz, 2007, Haider, 2009). Educational stakeholders can and will effect instructional change if given the possibility. For

that they need projects like IMST, which do not narrowly direct the change processes but leave space for the concerns of stakeholders, which provide the means to call in experts and cover other expenses, and which nevertheless care for and also actively support the quality of the change processes and their documentation. They also need expert institutions which provide expert consultations (at no costs to the schools) to facilitate an up-to-date understanding and knowledge of the situations under concern. Then, we may put our trust in stakeholders to increase the stakes.

References

Haider, R. (Producer). (2009). „VIA_MATH_3“ Förderung der Qualität und Attraktivität des Mathematikunterrichts durch das IMST-Bezirksnetzwerk Weiz I. Electronic Retrieved from http://imst.uni-klu.ac.at/imst-wiki/images/0/06/Langfassung_Haider.pdf (Accessed 28/09/2011)

Hanfstingl, B. & Krainer, K. (2008). IMST - Innovations in Mathematics, Science and Technology Teaching. *Unser Weg*, 63/2, 41-45.

Kittner, Angelika (2009): EVEU – Ein veränderter Elementarunterricht, der Rechenschwächen und Lese-Rechtschreibschwierigkeiten vorbeugt. Unveröffentlichtes Manuskript. Internet: http://imst3plus.aau.at/imst-wiki/images/e/e0/1505_Langfassung_Kittner.pdf (Accessed: 28/09/2011)

Kittner, Angelika (2010): EVEU – Ein veränderter Elementarunterricht, der Rechenschwächen und Lese-Rechtschreibschwierigkeiten vorbeugt. Unveröffentlichtes Manuskript. Internet: http://imst3plus.aau.at/imst-wiki/images/8/81/1814_Kittner_lang.pdf (Accessed: 28/09/2011)

Krainer, K. (2003). Innovations in Mathematics, Science and Technology Teaching (IMST²). Initial outcome of a nation-wide initiative for upper secondary schools in Austria. *Mathematics Education Review*, 16, April 2003, 49–60.

Krainer, K. (2008). Innovations in Mathematics, Science and Technology Teaching. In J. Vincent, J. Dowsey & R. Pierce (Eds.), *Connected Maths. MAV Annual Conference 2008* (pp. 199-212). Brunswick, Vic: The Mathematical Association of Victoria (MAV).

Krainer, K., Hanfstingl, B. & Zehetmeier, S. (Hrsg.) (2009). *Fragen zur Schule - Antworten aus Theorie und Praxis. Ergebnisse aus dem Projekt IMST*. Innsbruck: Studienverlag.

Krainz-Dürr, M. (1999). *Wie kommt Lernen in die Schule? Zur Lernfähigkeit der Schule als Organisation*. Innsbruck: Studienverlag.

Krainz-Dürr, M. (2006). Die Rolle von Lehrer/innen und Schulleiter/innen in Schulentwicklungsprozessen. In R. Boenicke, A. Hund, T. Rihm & V. Strittmatter-Haubold (Hrsg.), *Innovativ Schule entwickeln. Kompetenzen, Praxis und Visionen*. (S. 48-65). Heidelberg: Mattes.

Lorenz, J.H./Radatz, H. (1993) Handbuch des Förderns im Mathematik-Unterricht. Hannover: Schroedel-Verlag

Parkhurst, H. (1922). Education on the Dalton-Plan. New York, Dutton & Company.

Rauch, F. & Kreis, I. (Hrsg.) (2007). Lernen durch fachbezogene Schulentwicklung. Schulen gestalten Schwerpunkte in den Naturwissenschaften, Informatik und Mathematik. Innsbruck: Studienverlag.

Schuster, A. (2008). Warum Lehrerinnen und Lehrer schreiben. Wien, Alpen-Adria-Universität Klagenfurt. Dissertation.

Schwetz, H. (2007). Veränderung der Aufgaben- und Lernkultur im Mathematikunterricht. Wirkungen eines IMST-Projekts im Bezirk Weiz auf Schüler/innenebene [Changing the task- and learning culture in mathematics teaching. Effects of an IMST project on students' level in the district of Weiz]. Unpublished manuscript. Internet: http://imst.uni-klu.ac.at/materialien/2007/2410_IMST-Fonds-Weizabstract_schwetz-2007-10.pdf (Accessed 28/09/2011).

Zoltan, Gabriele (2008): Kleine Kinder erobern die Welt der großen Zahlen. Unpublished Manuscript. Internet: http://imst3plus.aau.at/imst-wiki/images/3/35/1134_Langfassung_Zoltan.pdf (Accessed 28/09/2011).

Zoltan, Gabriele (2009): Kleine Kinder erobern die Welt der großen Zahlen II. Unpublished Manuscript. Internet: http://imst3plus.aau.at/imst-wiki/images/1/14/1445_Langfassung_Zoltan.pdf Accessed (28/09/2011)

Zoltan, Laszlo; Turner, Andrea (2009): Neue Wege im Elementarunterricht. Unpublished Manuscript. Internet: http://imst3plus.aau.at/imst-wiki/images/a/a1/1450_Langfassung_Zoltan.pdf (Accessed 28/09/2011)