Challenges to the preparation of teachers of mathematics

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This article attempts a personal answer to the following two connected questions: "What are the most important problems in the preparation of mathematics teachers in view of the tasks, functions, and roles they have or ought to have in contemporary mathematics teaching?", and "What specific challenges to the preparation of teachers of mathematics do these problems generate?" These questions are posed as general ones with no particular reference to any specific country.

The answers which this article offers to these questions are based on three "axioms" concerning the job of a mathematics teacher and on a characterisation of the qualities which the "ideal, but unfortunately utopian, mathematics teacher" ought to possess. From this point of departure six major current problems in the preparation, roles and functioning of mathematics teachers are identified: (i) working and living conditions; (ii) qualitative and quantitative recruitment; (iii) pre- and in-service preparation and education; (iv) teachers' knowledge, beliefs and perceptions of mathematics; (v) teachers' knowledge, beliefs and perceptions of mathematics education and of the tasks, roles, and positions of mathematics teachers; (vi) professional development.

These problems are discussed in some detail and the article concludes by suggesting points which deserve particular attention in efforts to develop and improve the education of mathematics teachers: knowledge and perceptions concerning mathematical content and processes (we are talking about teachers of MATHEMATICS, not just about teachers); the need for enthusiastic and committed TEACHERS rather than people who are somewhat knowledgeable in mathematics and happen to teach it; the need for frameworks and environments for continuing professional growth and development.

This is a slightly revised manuscript of a plenary lecture given by the author at the ICMI-China Regional Conference on Mathematics Education, Shanghai, 16-20 August 1994.

1. Introduction

It is almost a matter of course (in fact: of definition) that all mathematics teaching takes place under the involvement of teachers of mathematics. It is true that mathematics teaching is sometimes brought about by technical media such as television or computer programs without a teacher ever being physically present in the same room as the students who are taught by these media. Nevertheless,

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this type of instruction is still rare, and – more importantly – the people who construct instruction programs, whether audiovisual or computer based, can be said to play the part of teachers even if they may not be trained as teachers or may never personally meet the students.

While the teaching of mathematics thus presupposes the involvement of teachers, the same is not the case with the learning of mathematics. It is certainly true that mathematical learning sometimes takes place without the direct or indirect involvement of mathematics teachers, also within the system of organised education. The relationship between the teaching and learning of mathematics is an intricate and intriguing one which in recent decades has attracted substantial and growing attention in the mathematics education community, also as far as the actual and potential roles of mathematics teachers are concerned.

However, if, as in this paper, our topic is the teaching of mathematics, any reasonable theoretical or empirical analysis must take into account the existence and importance of mathematics teachers. To mathematics education the teacher is a key person whose capacities provide key potentials to mathematics education and whose limitations constitute crucial limitations to it (cf. Howson, 1994).

In order to give this paper a clear focus let us ask ourselves: What are the most important problems in the preparation of mathematics teachers in view of the tasks, functions, and roles they have or ought to have in contemporary mathematics teaching? And what specific challenges to the preparation of teachers of mathematics do these problems generate? In order to establish a foundation for answering these questions, our first step will be to offer some background considerations.

2. The ideal mathematics teacher: impressions from Utopia

I should like to suggest three "axioms" as basic requirements with respect to the overall function and role of mathematics teachers:

> ***Axiom 1***: Teachers should be committed to equipping their students with mathematical knowledge, insight, and experiences which can serve them in their private, professional, and social lives. In other words, teachers should serve as genuine mentors rather than just paid employees.

Axiom 2: Teachers should be able, themselves, to do all the kinds of work their students are expected to do. In other words, teachers should possess at least the competence which will be required of their students. (This does not imply that they have to be as good achievers as the very best of their students).

Axiom 3: Usually, teachers will serve for several decades. They should be prepared (in several meanings of this word) to be active contributors to the development of mathematics education, even if this implies fundamental changes in the components and factors that determine the shape and functioning of mathematics teaching. In other words, in order to be agents and instruments for development rather than obstacles to or victims of change, teachers have to possess a considerable surplus of flexible competence which goes beyond the immediate everyday requirements.

To most mathematics educators, these axioms will probably appear to be fairly trivial (in fact, this is what we often expect from axioms, isn't it?). Yet, they might turn out to be less innocent than they seem, in particular when it comes to the consequences they may have, say, for the content and organisation of pre-service and in-service teacher training, for economic aspects of the educational system, for the conditions under which teachers live and work, and so forth. With these axioms in hand it is possible to describe briefly a set of – alas!: utopian – properties that, in my opinion, would be characteristics of the ideal mathematics teacher.

The ideal teacher of mathematics

(a) possesses a deep, wide and rich knowledge of and perception of mathematics in its multitude of dimensions and manifestations; thus (s)he is personally acquainted with not only mathematical theory, but also with aspects of mathematics as a subject and a science which has a history; which evolves in society as part of human culture in all its diversity; which, through mathematical models, is being used and applied in an overwhelmingly large number of different extra-mathematical contexts; which has intimate relationships with other subjects of almost any category, in comparison with which it has particularly intricate and much debated philosophical characteristics; which is not only an edifice of theoretical products but also an area of activity and process that includes problem posing, exploration, investigation, creation, problem solving;

(b) is continuously reflecting on the fundamental reasons for teaching mathematics to her/his categories of students and on how these reasons can be discussed, and perhaps shared, with students, with colleagues in other subjects, parents, neighbours, politicians, members of the general public;

(c) is in a continuing process of growth and development based on open-minded yet knowledge-oriented and reflective interest in people, mathematics, education, research, society, culture. Briefly put: such a teacher is professionally alive;

(d) is able to maintain, in the face of hardship, problems and troubles, a fundamental enthusiasm about the task of providing mathematical education to new (and, relatively speaking, ever younger) generations, without ever feeling tempted to think or say anything like "I have taught this stuff for so many years that the students ought to have learnt it by now";

(e) is able to flexibly set the stage of the mathematics teaching in her/his classrooms as an autonomous, reflective, and active individual who is willing and able to cooperate with others; such a teacher will not just be a 'puppet' who passively and uncritically bows to the demands and fashions of the day;

(f) is able to select and produce a rich variety of teaching materials and resources adjusted to the specific circumstances and needs of her/his students and classrooms;

(g) is able to organise, monitor, guide, and supervise a multitude of different study forms and activities suitable for work in and on mathematics;

(h) is able to communicate, within a spectrum of different ways and levels, with her/his students and with others in and about mathematics;

(i) is able to make the position and role of mathematics in society and culture visible and concrete to her/his students;

(j) possesses empirical and theoretical knowledge about typical ways in which students may experience, perceive, reflect on, and feel about mathematics, as well as knowledge about ways in which students may obtain and establish their mathematical knowledge, insight, and skills;

(k) is a person who is able to observe and investigate, in a scientific way, the learning processes and products of her/his students; in

other words, such a teacher is, in fact, able to carry out small-scale didactical and pedagogical research;

(l) is a person who is able to assess, in a multi-faceted, comprehensive and balanced way, the mathematical knowledge, insight and performance of her/his students and to communicate and discuss her/his findings with the students, individually or in groups.

It should be underlined that these qualifications are not meant to exhaust the set of properties that characterise the ideal mathematics teacher.

Furthermore, there is reason to believe that not every quarter associated with mathematics education would agree that all of these qualifications are indeed important characteristics of the ideal mathematics teacher, even if they could be achieved.

Some societies want their teachers to be obedient tools for the implementation of a centrally determined curriculum, a certain educational philosophy, or a certain kind of instructional practice, perhaps controlled by a tightly governed assessment system. For instance, one argument for this position could be to establish and maintain a unified and homogenous mathematical education throughout a vast country. Thus, in such a society it may not be a goal that teachers should be autonomous and independently active, inventive, and reflective.

Other educational systems traditionally emphasise that mathematics teachers should be keen and competent ambassadors of mathematics as a science to the institutions in which they work, maybe with the purpose of maintaining and controlling specific standards or of recruiting mathematical talents for further education. To such systems the main quality criterion is that teachers possess a solid and extensive knowledge of mathematics as a science, whereas no or little importance is given to the other characteristics outlined above. Not infrequently, several of these characteristics are considered to be superfluous or even potentially harmful to a true ambassador of mathematics.

In still other places, high priority is given to factors such as students' mental well-being, study joy and satisfaction, the creation of a friendly and stimulating working climate in the classroom, etc. Accordingly, teachers are expected to contribute to these ends. Sometimes, to the extent mathematics provides obstacles to these ends, teachers are expected to know how to circumvent them even if this implies reduced emphasis on mathematics. Pointedly put: teachers should be ambassadors of their students to mathematics, rather than the other way

round. In educational systems based on this notion, there is a tendency to train teachers as generalists with no deep or extensive preparation in mathematics, as a matter of fact often without an identity as mathematics teachers. Occasionally, one may even encounter proponents of this point of view who think that too much knowledge of mathematics can prevent teachers from being genuine advocates of their students.

Although the description in the last three paragraphs may appear to be slightly exaggerated, it is not too difficult to find quarters which would not agree to the above characterisation of the ideal mathematics teacher. However, a much more widespread and not at all surprising reaction is that these requirements might be beautiful and well justified in a perfect world but are, unfortunately, wildly unrealistic in the world in which we actually live. And evidently, if taken literally, the characteristics suggested would make an ideal mathematics teacher a pure mathematician; an applied mathematician; a historian, sociologist, and philosopher of mathematics; a researcher of mathematics education; a philosopher of science; a general and educational sociologist; a general educationalist; an empathetic pedagogue; a psychologist; a politician; a charismatic inspirer and leader; a communication expert; an entertainer (including a humorist and magician); a therapist; a priest; a textbook author, if not a writer; and a few dozen other things as well. As this would equip our ideal mathematics teacher with an impressive set of qualifications for numerous full-fledged professions it is true that we are indeed referring to Utopia.

The relevance of utopic considerations?

Aren't we wasting our time, then? What is the use of listing characteristics of an individual who can never exist? I should like to suggest four components of an answer to this question.

First, when in our less glittering real world of everyday constraints, pragmatism and compromise we are to design, organise, and implement feasible ways to prepare teachers of mathematics, it is essential to clarify what we consider to be important qualifications that mathematics teachers ought to posses, in order to enable us

(a) to choose the qualifications on which we want to insist, the ones to which we would give second priority, and the ones that – considering the circumstances, including the inevitable compromises between ideals and reality – may be given little or no weight;

(b) to know what we lose, and hence are likely to miss, as a consequence of the choices made under (a). That would allow for a revision, for instance due to changing circumstances, of our priorities by consultation of our utopian list of qualifications.

Second, if everyday constraints, problems and practicalities are allowed to dominate our notions and perceptions, this is likely to generate a lower level of ambition for the preparation of mathematics teacher than need be. If we haven't clarified what we should like to obtain, it is almost certain that we shall have less than we might have had.

Third, mathematics teaching and learning are very difficult and demanding endeavours. A multitude of obstacles, problems, occasionally even crises, occur every now and then and give rise to calls for new strategies, change, reform, etc. concerning the entire complex of mathematics education. In such situations some people are often tempted to identify the problems as lying with the teachers, in one way or another. Sometimes this may well be the case, but sometimes it may be misleading or simply wrong. At any rate, in most cases the problems are too complex and multi-dimensional to be ascribed to the teachers only. Our ability to analyse the teaching/learning problems, identify their roots and sources, and to devise strategies to deal with them depends on a clear and well-founded picture of the possible qualifications, functions, and roles of the teachers.

Fourth, it is an often reported observation that mathematics educators' perceptions of mathematics and mathematics education are not identical with those found in society in general, neither in the general public, nor amongst politicians, administrative authorities, employers, or educators in other subjects. Since for obvious reasons (one of which is economy) the education and preparation of mathematics teachers do not belong solely to the sphere of "internal affairs" of mathematics education, mathematics educators often have to discuss and negotiate the framework and conditions for the training of mathematics teachers with others, including people in legal, political or economic power. For such discussions to be fruitful, it is crucial that mathematics educators have clear and articulate conceptions of what an ideal mathematics teacher should look like and of what should and could be accomplished in actual practice in negotiations with parties, some of which may also have legitimate and well-founded interests to promote and defend.

Thus, it seems fair to conclude that it does, indeed, make good sense to invest some effort in trying to identify, analyse and discuss the

characteristics of the ideal mathematics teacher. However, it should not pass unnoticed that to several countries around the world it may well appear as quite a luxury problem to establish a long list of needs and wishes concerning the preparation of mathematics teachers. In many countries it is a far more serious problem just to acquire a sufficient supply of teachers who have a minimum knowledge of mathematics than to discuss what additional qualifications would be desirable. But, an attempt to solve this problem is first of all a socio-economic and political matter and to a lesser extent a problem to which scientific analysis and academic debate have much to offer.

3. Major current problems in the preparation, roles and functioning of mathematics teachers

From an overview perspective, it seems that the problems related to the functioning and roles of mathematics teachers belong to different main categories, including

(i) the overall working and living conditions of mathematics teachers;

(ii) the recruitment to the mathematics teaching profession;

(iii) the pre-service and in-service preparation and education of mathematics teachers;

(iv) teachers' knowledge, beliefs and perceptions of mathematics;

(v) teachers' knowledge, beliefs and perceptions of mathematics education and of the tasks, roles and positions of mathematics teachers;

(vi) the professional development of mathematics teachers.

For each of these categories I shall select and discuss below one or two key problems. These will have to be stated as generalisations which will not necessarily be valid everywhere. I would like to apologise in advance to countries or places in which the problems I shall be raising happen to be absent.

(i) & (ii): In addition to the problem of serving the basic needs for teachers who have a minimum knowledge of mathematics, mentioned in the preceding section, there are other problems that are essential but in a way "exterior" to mathematics education, because they are not mainly of a scientific/academic nature. These include teachers' working conditions, social recognition and prestige, salaries, and so forth.

No matter what splendid requirements we should like to put forward with regard to the preparation of mathematics teachers, it is unlikely that these requirements will ever be met if there are marked differences between the conditions, environment, encouragement, career and reward structure, etc., of teachers and those of other categories of professionals at comparable educational levels, not even if teachers were to be recruited by force. Even the most brilliant professional will be a poor teacher if (s)he lacks enthusiasm, energy, creativity, drive for further development, and to most people this is the case if other occupations are more attractive to individuals with backgrounds similar to theirs. It is not primarily a matter of enjoying certain privileges, for instance high salaries. Rather it is a matter of feeling that society values education, and hence the teaching profession, by spending a fair share of what it can afford on providing reasonable conditions for teaching and learning.

Although, as we said, mathematics educators normally cannot exert much influence in these matters, it is not seldom the case that the working and living conditions of teachers are of considerably lower standards than needed for the fulfilment of the task in hand, whether defined by society at large or by the professionals themselves. And, again, this has a negative "back-wash effect" on the functioning, recruitment and – hence – the preparation of mathematics teachers. If it is an established fact in the public perception that there is a mismatch between the qualifications required of mathematics teachers and the quality of the general conditions of the profession, only small numbers of able youngsters will want to enter the profession. In other words, there has to be a minimum social compatibility between requirements and conditions.

Let us now turn to the other categories of problems, (iii)-(vi), which are related more directly to the specific functioning and role of mathematics teachers and which may be influenced by the mathematics education community.

(iii): In many countries primary (elementary) school teachers are trained and educated as general teachers without specialisation in any particular subject, mathematics included. There might be several excellent and convincing reasons for such an arrangement. Moreover, teachers educated in this way are sometimes great teachers of mathematics, provided they have sufficient knowledge of mathematics and competence in mathematics education. In other words, if general, non-specialist, teacher training programmes imply that all graduates acquire a solid background in mathematics and mathema-

tics education, there may be no problem here at all; on the contrary, this type of programme may be very valuable indeed. If, however, this is not the case – and in some places it isn't – there are evident and serious problems. We only need to refer to Axiom 2 in the preceding section.

If we turn to consider the preparation of teachers for whom the subject of mathematics is a major part of their studies, I should like to address two issues.

(1) As noted in Axiom 3, teachers will normally serve in the profession for several decades. It is most unlikely that mathematics education is going to remain unchanged for such a long time. In a changing world, mathematics education changes as well. Accordingly, from time to time any mathematics teacher will be faced with calls for innovation and reform in the teaching and learning of mathematics. Sometimes, the demands for change concentrate on subject matter (for example, new topics in the curriculum) or other aspects of content and product. At other times, student activities, working methods, and classroom organisation (for example, small group work on problem solving), or other process aspects of mathematics education are in focus. In the real world it will never be possible to provide future teachers with pre-service education so rich and strong that everything they will ever need in their teaching career has been adequately and sufficiently dealt with in their pre-service preparation.

Thus, mathematics teachers have to be involved in a continuous process of organised professional development. Whether this process includes formal in-service courses or is based on other modes of operation is not so important. The important thing is that teachers are expected, encouraged, and stimulated to be involved in a variety of activities to bring about professional development. The fact that no pre-service training can supply preparation for a life-long teaching career should not be taken to imply that pre-service education can then be replaced by in-service training. On the contrary, it seems that for teachers to take proper advantage of in-service programmes they need a solid pre-service foundation.

Unfortunately, in many countries it seems to be a prevalent view that pre-service preparation does not have to be followed up by an organised system of in-service education for the ordinary teacher. It is not uncommon that teachers are encouraged to engage in in-service programmes on an individual and private basis (often also in financial terms), but it would not be fair to claim that this is not appreciated in these countries. In fact teachers' willingness and ability to engage in further education may be a key parameter for promotion etc. The

problem occurs when society does not want to raise expectations in the ordinary teacher and invest resources in her/his professional development. In such countries, innovation in mathematics education is often a non-smooth process: For a long time nothing happens; then a large scale reform campaign – often designed from above and including extensive in-service courses of the one-way communication type – produces discontinuity, turbulence, weariness, dissatisfaction and disengagement, and since this is exhausting and frustrating once again nothing will happen for a long time.

(2) Traditionally, in many countries pre- and in-service teacher education programmes have paid much attention to teaching methods, i.e. the techniques used, or considered usable, in the classroom to transmit knowledge, insight and skills related to a certain body of well-defined mathematical content and processes. It is a typical feature of issues of teaching method that they do not deal with the question of "why?" or "what?" in mathematics education, only with "how?". This tends to produce amongst mathematics teachers a narrow, unreflective, and conservative perception of mathematics teaching as being the static delivery of unquestionable subject matter to objectified recipients.

Since it is fairly certain that the task of a mathematics teacher cannot be static but calls for a flexible, active and reflective teacher, a strong emphasis on method will almost certainly result in insufficient and inappropriate teacher preparation. Instead, the preparation of teachers should have a broader and more multi-faceted perspective and deal also with the questions of "why?", "for whom?", and "what?", and – perhaps even more importantly – with ways of identifying, examining and influencing students' learning processes, as well as with the other items suggested in the description of the ideal mathematics teacher. Issues such as these belong to the realm of the didactics of mathematics. In other words, the traditional concentration on teaching method does not allow for a much needed general emphasis on didactics.

(iv): If we want to have mathematics teachers who can make mathematics visible, concrete and relevant to their students (item (i) in Section 2); who can motivate and justify the pursuit of mathematical studies to them (Section 2, (b)); who can foster coherent, varied, balanced, and rich perceptions of mathematics with their students, and who can teach them to perform creative work (modelling, pure or applied problem posing and problem solving) in and with mathematics, it is a serious problem indeed if the teachers' own notions of

mathematics are confined to considering mathematics as just a theoretical edifice, established by external and remote authorities and governed by rules and procedures that you should not expect to be able to understand or question.

Therefore, it is a dominant problem in many places around the world that mathematics teachers, at practically speaking every level, are acquainted only with the most basic aspects of mathematics. Often they maintain low-dimensional and over-simplified images of – and have correspondingly limited experiences with – those aspects of mathematics that justify its importance and make it rich: its application to extra-mathematical areas, brought about by mathematical model building; its history and philosophy; its position and function in society; its activity and process characteristics, and so forth (cf. (a) in Section 2). Normally neither pre-service preparation nor in-service programmes pay any attention worth mentioning to these dimensions of mathematics. I see this as one of the crucial overall deficiencies in the preparation and education we offer to future mathematics teachers.

(v): Mathematics teachers who maintain restricted perceptions of mathematics are also likely to maintain restricted perceptions of mathematics education and of their tasks and roles as teachers. The more stereotyped their images of mathematics are, the more stereotyped their teaching is likely to be. Teachers who think that mathematical competence consists of knowing a set of definitions, theorems and various other facts and of the skill to practise certain procedures under the observation of certain rules may tend to perceive her/his role as being a one-way transmitter of the elements of such competence.

Moreover, teachers of this belief may tend to equate students' mathematical knowledge, insight and achievements with the extent to which they, under test conditions, can carry out procedures quickly and correctly, and they will assess them accordingly. Such a view of assessment does not enable teachers to "assess, in a multi-faceted, comprehensive and balanced way, the mathematical knowledge, insight and performance of her/his students and to communicate and discuss her/his findings with the students" (Section 2, (l)) nor to "investigate, in a scientific way, the learning process and products of her/his students" (Section 2, (k)).

There are other problems related to teachers' notions of mathematics education and to their views of the tasks and roles of a mathematics teacher.

One is that they frequently think of their profession and its tasks in too humble and unambitious terms. In many countries it is not unusual

that teachers think that it is not, and should not be, their business to be involved in discussing and determining the purposes, goals, aims and objectives of mathematics education, or its curriculum components (e.g. content, aspects and activities). Such matters, they think, should be left for administrative and political authorities or experts to deal with. Teachers should be loyal instruments for the implementation of the ideas and plans determined at higher levels of decision. But this attitude is inadequate for professionally alive, enthusiastic teachers with a capacity to reflect on and discuss with their students the justification, organisation and content of mathematics education and to flexibly set the stage of mathematics teaching in their classrooms.

Another (related) problem is that only too seldom do teachers consider themselves as resourceful educators who could and should undertake small scale didactical and pedagogical research and development in their own, local environment. However, this is badly needed if we want mathematics teachers to identify, examine, understand, and influence the learning of their students.

In conclusion, notions of mathematics teaching and teachers such as those outlined above are inadequate if we want to insist on Axioms 1 and 2, and to take the characteristics (a)-(l) (Section 2) of the ideal mathematics teacher seriously.

(vi): Perhaps the most severe overall problem in the current functioning and roles of mathematics teachers is a tendency towards professional stagnation. It is not unusual that after some years in the trade many mathematics teachers lose their fundamental enthusiasm, vitality, practical and scholarly curiosity, and the drive for development without which they cannot fulfil their tasks satisfactorily.

There are several causes for this, many of which are of an external nature and thus not entirely under the teachers' own control (cf. (i) & (ii) in this section).

Also in many places there is lack of incentives, stimulation, encouragement – or just sources and resources – for professional development. Another cause is that in many educational systems promotion implies that the teacher leaves everyday teaching to become an administrator, a supervisor, or a consultant. So, the fact that stagnation is a dangerous pitfall to the mathematics teaching profession should not be taken to imply that the individual teacher is the one to blame.

Unless we can create incentives, conditions, environments, frameworks and modes of implementation for continuing professional development of mathematics teachers we shall never succeed in our

efforts to obtain sensible approximations to the ideal mathematics teacher. Whatever splendid ideas we may have to solve or counteract the other problems described above they will be without effect in front of an inert corps of teachers who are not in professional motion to claim new land for mathematics education.

4. Concluding remarks

In the preceding section I have attempted to identify the most significant current problems in the roles and preparation of mathematics teachers. It is now natural to ask what we can do about them.

First of all, we have to realise that there exist no universal miraculous cures or master plans that would remove or solve the problems encountered. Preparing and educating mathematics teachers are complex, intricate, delicate, and demanding affairs which require a multitude of different approaches that pay due attention to the specific conditions and circumstances of the countries or places at issue. This can be done in infinite number of ways, none of which are canonical. Moderate yet significant improvements are possible in the real world in relation to each of items (a)-(l) of Section 2.

So, we have to be cautious to avoid undue generalisations. Nevertheless, if we agree to do our best to educate mathematics teachers in accordance with the ideals suggested in preceding sections, it seems necessary to observe certain minimum demands:

- Mathematics teachers have to be equipped with knowledge and perceptions of mathematics which include, in addition to mathematical theory, the following aspects: mathematical applications and modelling; the history and social contexts of mathematics; the philosophical characteristics of mathematics; processes of mathematical investigation.
- Mathematics teachers have to be educated to become teachers, not just people who are knowledgeable in mathematics and happen to teach it. In so doing, we should strive to foster enthusiasm, commitment, human and scientific curiosity, and capacity in teachers.
- We have to do our best to provide conditions and create frameworks and environments for continuing professional growth and development.

As stated in a previous section, it is evidently not possible to provide teachers with such qualities in the course of their pre-service preparation alone. Systematic in-service education has to be made available to them. The exact division of labour and balance between pre-service and in-service education is of secondary importance. What is of primary importance is that both components are substantial and are taken seriously by all those involved as well as by the educational system in which they function.

Reference

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Udfordringer til uddannelsen af matematiklærere

Resumé

Artiklen forsøger at give personlige svar på to sammenhængende spørgsmål: "hvad er hovedproblemerne i uddannelsen af matematiklærere set i lyset af de opgaver, funktioner og roller de har eller burde have i vore dages matematikundervisning?" og "hvilke udfordringer stiller disse problemer uddannelsen af matematiklærere over for?". Spørgsmålet skal forstås alment og ikke med reference til forholdene i noget bestemt land.

De svar på spørgsmålene som artiklen tilbyder, hviler på tre "aksiomer" vedrørende matematiklærergerningen samt på en karakteristik af de kvaliteter den "ideelle, men desværre utopiske, matematiklærer" bør udstyres med. Med dette udgangspunkt udpeges seks hovedproblemer ved matematiklærerens uddannelse, virke og rolle:

(i) arbejds- og levevilkår,

(ii) kvantitativ og kvalitativ rekruttering,

(iii) uddannelsesbaggrund, efter- og videreuddannelse,

(iv) lærernes viden, forestillinger og erfaringer vedrørende matematik,

(v) lærernes viden, forestillinger og erfaringer vedrørende matematikundervisning, og angående matematiklærerens opgaver, rolle og placering,

(iv) professionel udvikling.

Disse hovedproblemer diskuteres i nogen detalje, og artiklen slutter med at foreslå punkter, der bør vies særlig opmærksomhed i bestræbelserne på at udvikle og forbedre uddannelsen af matematiklærere: viden og forestillinger om indhold og processer i matematik (det er ***matematik***lærere vi taler om, ikke blot lærere); betoning af behovet for engagerede ***lærere*** frem for blot og bart (mere eller mindre) matematikkyndige der tilfældigvis underviser; det er essentielt at skabe rammer og miljø for professionel vækst og udvikling.

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