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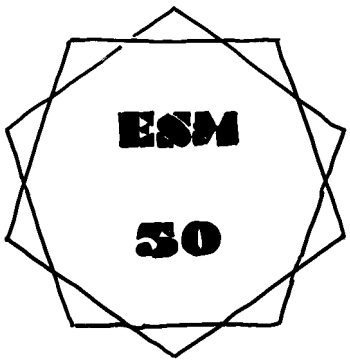
THE STORY OF ESM



ABSTRACT. This paper looks at the origins of the international journal *Educational Studies in Mathematics* (*ESM*) in 1968 and traces its later development as it responded to changes in mathematics education. The paper first examines, in chronological order, the contributions of its editors in defining its spirit, policy and procedures, as they directed its growth and its transformation into a leading journal of research in mathematics education. The paper then presents a statistical profile of ESM articles by content area, educational issue, level of schooling and research method, and goes on to look more closely at the special issues of *ESM*, each dedicated to a single topic, and how they reflect the changing concerns of mathematics educators.

KEY WORDS: history, history of journals, mathematics education, research methods

1. INTRODUCTION

This article is occasioned by a significant milestone: *Educational Studies in Mathematics* has now reached Volume 50. With so many developments since the inception of the journal in 1968, doing justice to the story of *ESM* over the last 35 years is a daunting task. There is no single theme one can pursue to portray accurately a journal that did so much in so many ways to advance the art and science of mathematics education research.

In this paper we describe both the formative years of *ESM* and its later progress in solidifying its publishing philosophy and its position as one of the most important journals of mathematics education. We have sought

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to make clear not only how its content has changed over the years, as new concerns and methods emerged in mathematics education research, but also how its procedures and editorial approaches have changed in step with these changes in content and with a growing publishing load.

There cannot be a single story of *ESM*, of course. Its history could be recounted in different ways, each placing the emphasis on a different aspect. We have chosen a straightforward approach, first following the development of the journal in chronological order, describing along the way who did what, when, how, and why. We then present a statistical profile of *ESM* articles, and lastly look in greater detail at the special issues that have become an important feature of the journal.

This paper pays tribute to the many editors and authors who have contributed to the success of *ESM* and who continue to make it a rich source of innovative ideas for both academics and teachers.

2. A CHRONOLOGY

2.1. *Freudenthal*

Educational Studies in Mathematics (*ESM*) was born out of the International Commission on Mathematical Instruction (ICMI). Since the inception of ICMI in 1908, its official journal was *L'Enseignement Mathématique,* which had been founded by Henri Fehr (Geneva) and Charles-Ange Laisant (Paris) in 1899. At the 1964 ICMI *Colloquium on Modern Curricula in Secondary Education* held at Utrecht University, André Revuz, in particular, openly questioned the continued appropriateness of this relationship. It was felt that *L'Enseignement Mathématique* was of more interest to mathematicians than to mathematics educators, and that an ICMI journal should accommodate more languages. As Howson (1984, p. 86) put it "The need for other publications, possibly in several languages, was discussed, and a committee was established to consider the problem." The following resolution was adopted:

> The participants in the Utrecht Colloquium on *Modern Curricula in Secondary Education* feel the urgent need for more international information on national activities in mathematics education, which could be organized and spread by an active and accessible international center of information or by a high level periodical on mathematical education. (Freudenthal, 1978b, pp. i–ii)

Although the ICMI itself did not take any action at that time, in the following year the ICMI's new president, Hans Freudenthal, sent out a circular letter, which began:

In order to carry out a resolution adopted at ... Utrecht in December 1964, I have taken steps to arrive at publishing a high level international periodical on mathematics education. The publishers Reidel at Dordrecht (Netherlands) appear to be favourably inclined towards such a project. (Freudenthal, 1978b, pp. i–ii)

Freudenthal chose the first Editorial Board with Peter Hilton, who also gave the journal its name, *Educational Studies in Mathematics* (ESM). Freudenthal also determined that the journal would begin with the proceedings of an ICMI-sponsored colloquium held at Utrecht in 1967. Indeed, the first two volumes of the journal were devoted to ICMI matters (Howson, 1984, p. 86).

At the beginning of Freudenthal's term as President of ICMI, nearly all of its funding came from the International Mathematical Union (IMU) (Lehto, 1991, p. 258). Freudenthal exercised a certain amount of autonomy, however, not necessarily seeking the counsel of IMU's executive committee or informing it of his decisions. In order to fund the creation of *ESM,* Freudenthal sought the help of the United Nations Educational, Scientific, and Cultural Organization (UNESCO), and ICMI signed a contract with UNESCO for support in the creation of *ESM.* Although IMU had not been informed of this, its executive committee, in its 1969 meeting, chose to support Freudenthal's actions, stating that "The IMU should continue its policy of paying special attention to educational questions through ICMI" (Lehto, 1991, p. 260). However, as a result of other problems between Freudenthal and the IMU Executive Committee, ESM was never an official ICMI journal.[1]

Freudenthal did not begin the first issue of *ESM* with an editorial. By way of introduction, Volume 1 of the journal began in 1968 with his opening address at the 1967 ICMI colloquium, entitled "Why to Teach Mathematics so as To Be Useful." This talk sketched, in a general way, Freudenthal's own views on mathematics education. It also cited the resolutions adopted at a conference of mathematics teachers in Lausanne as a milestone in the philosophy of mathematical education. These resolutions appear later in the same volume under the heading "Propositions on the Teaching of Mathematics,"[2] and may be seen as indicative of the philosophy that Freudenthal wanted *ESM* to embody.

The first proposition states that mathematics is a unique and characteristic human activity and that all children have the right to mathematics instruction. The second reads as follows:

(2) In order to be adequate for the purposes of a progressing world this education must provoke and develop in the first place the capacity of intellectual action instead of merely piling up knowledge.[3]

The following three propositions claim that mathematics is a general science of structures, that elementary structures ought to be learned in childhood, and that more advanced structures should be acquired by the end of secondary school, and the next two address teacher training, asserting that mathematical teaching will never be formulated once and for all, and that teachers will need to be continuously retrained. The last proposition is the following:

> (8) An effective global collaboration in this field will become indispensable. It is an urgent requirement to establish an international organism for information on the teaching of mathematics.[4]

These propositions contain the core ideas which were fundamental to Freudenthal's vision of *ESM* and which were revisited again and again: 1) that mathematics education is for everybody, 2) that the purpose of mathematics education is not merely the acquisition of mathematical knowledge, 3) that mathematics education will need to be continuously reformulated, and 4) that mathematics instruction is a global project which can benefit from an international perspective.

Freudenthal edited nine volumes of *ESM* in the ten years of his editorship. He chose his seventeen-member editorial board himself, in consultation with Peter Hilton. The board members were mostly drawn from European countries.[5] It is not clear what practical role the first editorial board played in matters of content. Certainly, papers were selected at Freudenthal's discretion; thus when Geoffrey Howson submitted his first paper to *ESM* in 1973 on "Charles Godfrey and the reform of mathematics education", a historical study, he was somewhat surprised to receive a reply from Freudenthal to the effect that "There are only two rules governing papers to be accepted for *ESM*. The first is that *ESM* does not publish papers on the history of mathematics or mathematics education. The second is that all rules can be changed." The paper was accepted.[6] The review process, if there was one, was never formalized. After Alan Bishop took over as editor in 1978, Freudenthal told Bishop that "He would send [the editorial board] a note saying 'I intend to publish the following articles in the next issue. Please let me know if you would like to read any of them.' "[7]

Because of his relative autonomy, the articles published in *ESM* very likely reflected Freudenthal's own views of the importance of certain subjects. At the Geneva meeting of the ICMI in 1955, for instance, Freudenthal laid great weight on the importance of teaching geometry and, as we shall see in the statistical analysis of topics for *ESM* articles, geometry as a topic was better represented during Freudenthal's editorship than any other subject (Howson, 1984, p. 82). An analysis of the topics covered in *ESM* while Freudenthal was editor will be taken up below.

During Freudenthal's tenure as editor, *ESM* published papers in English, French, and German. Freudenthal made efforts to publish papers by authors from as many different countries as possible. For instance, he always tried to publish any paper from China, since so few were received.[8] Both Freudenthal and his successor found conferences to be a good source of papers, and in the first ten years a number of special issues were dedicated to presentations given at such conferences, including the first meeting of the International Group for the Psychology of Mathematics Education (PME).

Two other special issues were devoted to the reports of researchers from 16 countries on the changes in mathematics education during the rise and development of the "New Math", 1950–1978. These reports examined changes not only in practices, but also in the stated goals of mathematics education, both those that had been achieved and those that had not, and in educational philosophy. These special issues were introduced by the letter that Freudenthal had sent as a call for papers (*ESM 9*, 1978, pp. 143–504).

If we want to learn about the interests of *ESM's* first editor from its pages, there are really only a few places where we can look. The address with which *ESM* began, and the propositions also included in the first volume, have already been mentioned. In addition, Volume 9 started with the address that Freudenthal gave at the first PME conference in Utrecht in 1977 (Freudenthal, 1978a), and here again we may find some information on his educational philosophy and the principles by which he edited *ESM*.

On the whole, however, Freudenthal was reticent when it came to editorials, statements of policy, or suggestions for authors. The first editorial that he wrote for *ESM* was also his last. He edited all the issues published during his term; there were no guest editors. During Freudenthal's term as editor, *ESM* had no statement of policy and no guidelines for submissions. This was the advice he offered his successor, Alan Bishop: "There are two important qualities to have as an editor; first, you should be really fussy. Some of the nonsense people send you is amazing! But second you should not be too fussy otherwise you will have nothing to publish!!"[9]

2.2. *Bishop*

When Alan Bishop took over the task of editing *ESM* in 1978, the editorial board, which had not changed during the journal's first ten years, collectively retired, as Freudenthal had suggested, and Bishop appointed a new board (Freudenthal, 1978b). Though more countries were represented in Bishop's editorial board, it was still predominantly European.[10] Bishop made it his habit to seek the advice of the editorial board where Freudenthal had not. During Bishop's term as editor, every manuscript was

reviewed by at least two members of the editorial board. As *ESM* published papers in English and French, Bishop took care that one of the reviewers be a native speaker of the language in which the paper was written, while the other generally was not (Bishop, 1993).

Bishop began his first issue of *ESM* with an "Editorial Statement." (Bishop, 1979). In this statement he claimed that the field of mathematics education studied three essential areas: 1) "children's mathematical abilities and thinking processes," 2) "the methods and techniques used by mathematics teachers," and 3) the content of the mathematics lessons. In explication of the third category, however, he introduced another area of study that seems to form its own category and became increasingly important in the years to come, namely 4) "the cultural context of mathematics." This editorial statement also contains the first step towards a statement of policy. Bishop (1979) wrote of *ESM* that

> It seeks to present those new ideas and developments which are of significance to those working in this sphere. It reflects the range of methods used nowadays to those working in this field – historical analysis, philosophical analysis, observation, clinical overview, experiment and survey. Furthermore it recognizes the fact that although there exist obvious local and national differences in the organization and procedures of mathematics teaching, this field is an international one, and there is much one can gain from ideas developed in contexts that may be very different from our own. (Bishop, 1979, p. i)

Bishop wrote his second editorial in 1985 on the occasion of Freudenthal's 80th birthday, celebrating his contribution to the journal. It was in the following year that Bishop's statement of editorial policy first appeared, the one that is still found at the beginning of every issue of *ESM*.

Bishop saw the range of research methods increase greatly during his term. As he later recalled, the survey of research methods mentioned in his opening editorial was intended to send the message that no paper would be ruled out on the basis of its methods.[11] Throughout his term as editor, he worked to make *ESM* as inclusive as possible, while still maintaining the level of rigour that Freudenthal had given it. The statement of editorial policy that *ESM* adopted in 1986 reflects this desire. It reads:

> *Educational Studies in Mathematics* presents new ideas and developments which are considered to be of major importance to those working in the field of mathematics education. It seeks to reflect both the variety of research concerns within this field and the range of methods used to study them. It deals with didactical, methodological and pedagogical subjects rather than with specific programmes for teaching mathematics. All papers are strictly refereed and the emphasis is on high-level articles which are of more than local importance.

By the time Bishop stepped down, to be replaced by Willibald Dörfler, this editorial statement reflected not only the intention of the journal but

its practice as well. When Bishop took over *ESM* there had been no peer review. Although it was never formalized or well documented, Bishop's policy was to use only the members of the editorial board as reviewers. He did this to lend to the journal a distinct style. The direction and character of *ESM* were developed by Bishop in consultation with the editorial board, with whom he would meet at the various mathematics education conferences.[12]

In 1986 and throughout Bishop's tenure *ESM* put out a number of special issues devoted to a single topic, edited by guest editors and introduced by an editorial. This was the beginning of an *ESM* tradition that continues to the present day. Special issues strongly reflect the trends in mathematics education and the role of ESM, and so will be described later in some detail.

Starting with the first issue of Volume 12, Bishop added a book review editor to the editorial team, responsible for soliciting independent reviews that extend the range of topics addressed in the journal. He also introduced the idea of short communications, the first of which appeared in the first issue of Volume 16.

Bishop edited 11 volumes of *ESM* during his editorship (and it was in that period, in 1988, that the publisher D. Reidel merged with a number of other publishers to become Kluwer Academic Publishers[13]). When he took over the journal there was no defined review process and no editorial policy, so that everything depended upon him, but he took care during his editorship to develop policies and procedures that would give the journal a life of its own. By the time he stepped down, *ESM* had a statement of policy that reflected the actual practice of the journal, a working editorial board, and a well-understood review process, albeit informal and undocumented.

2.3. *Dörfler*

Willibald Dörfler became *ESM's* new editor-in-chief in 1990. When he took over, he insisted that he be supported by two additional editors, Gila Hanna and Leen Streefland (Dörfler, 1993b, p. 82). This gave the editorial team a greater "geographic, cultural and scientific spread" (Dörfler, 1990), and helped it handle the increased workload as the journal grew. Because Bishop had already established the practice of gradually replacing its members, there was no need for any drastic changes in the editorial board. A few more members retired in 1990 and were replaced. The board was now larger, and, although most were still from Western Europe and North America, there were now members from Central and South America and from Africa.[14]

The statement of editorial policy that had appeared during Bishop's editorship was left unchanged because, as Dörfler (1990) said, "It is flexible enough to encompass virtually all conceivable developments in mathematics education." This openness and flexibility was central to the editorial team's view of how *ESM* could best serve mathematics educators. As Dörfler (1990) wrote in his first editorial,

> In our view, like any science and possibly more so, mathematics education has no well-defined borderlines and has predominantly to be considered as a social process of constructing viable knowledge for potential use in the practice of teaching. Such a process is an open-ended endeavor which does not allow us to decide well in advance what will contribute positively to its progress. In this sense, as was done in the past, we want to encourage a broad range of authors and articles representing research from different backgrounds and from many neighboring disciplines to contribute to ESM. (Dörfler, 1990, p. 1–2)

During Dörfler's term as editor many of the practices and procedures that had been established during Bishop's term were made explicit. The editorial team was made up of the editor-in-chief, the two additional editors, and a book review editor, supported by the editorial board. The board comprised 20, and then 25 members chosen to represent as broad as possible a range in terms of location, culture, nationality, and theoretical orientation. The term of the editor-in-chief as well as that of the two co-editors was set at five years, with the possibility of extension. The board members had no fixed term, but in practice they served from five to ten years (Dörfler, 1994).

Under Dörfler, the review process in particular was formalized and documented. Manuscripts were submitted to the editor-in-chief, who divided them up amongst the three main editors based on workload. The editor responsible then sent the paper out to two to four reviewers. As under Bishop, most reviews were done by members of the board, but an outside reviewer might be used if there were a need for a specialist in the area dealt with in the paper. Sometimes all the reviews were in agreement and a paper could be rejected or accepted with minor corrections. Most often, however, the editor responsible for the paper asked the author to make revisions suggested by the reviewers. This began a process of negotiation between the author and the editor. Sometimes a second round of reviews was required. Dörfler felt that this process helped authors present their work in the best light and helped the journal "make the best out of the available current research work" (1993b, p. 84).

This process is essentially that used by *ESM* today, one in which the editors continue to play a key role. Reviewers bring their own points of view and even biases to their evaluations, sometimes present arguments that are less than compelling, and occasionally fail to understand the point of a

manuscript. Thus the editor in charge of the manuscript (who might be the chief editor) must take responsibility for the ultimate decision on whether it is to be accepted as is, rejected outright, or returned for modification. The advice of reviewers is extremely valuable, however, even when it is conflicting. It is by weighing the arguments of reviewers carefully, consulting with other members of the editorial board where necessary, that the editors are best able to make a decision that reflects the scientific value of a manuscript and its potential contribution to the continued good reputation of the journal.

Dörfler thought that special issues dealing with single topics "constitute a possible and powerful tool for opening up new avenues of research, for bringing... undervalued fields to the foreground or to enhance the discourse in general" (Dörfler, 1993b, pp. 84–85). Special issues had appeared earlier, as we have seen, but Dörfler took the step of formalizing this feature. In an editorial introducing the first issue of Volume 25 (dedicated to Freudenthal), Dörfler (1993a, p. v–vi) announced the 'innovation' of special issues. Each special issue was to be edited by a guest editor whose task it would be to solicit contributions from authors and to oversee the review process, which was otherwise the same as that described above. We treat the special issues in more detail later in this paper.

In 1992, at a symposium held in Gilleleje, Denmark, Dörfler gave a talk on the quality criteria for *ESM*, in which he addressed criteria that editors should bear in mind as they are considering a paper or working with an author in the revision process. Among them were the following: (1) The rationale for the research should be explicitly formulated and explained; (2) the background philosophy should be stated and recognizable, (3) the research results should be presented and separated from the interpretation, and (4) the relevance of the research to mathematics education should be made clear (Döfler, 1993b, p. 85–87). Although this talk was published, it was only in 1996, when Kenneth Ruthven took over as editor-in-chief, that these criteria were made explicit in the pages of *ESM* itself (Ruthven, 1996b, p. 3–4).

ESM doubled in size during Dörfler's term as editor-in-chief. With the 1990 volume, the first one he edited, the journal expanded from four to six issues per year (Dörfler, 1990, p. 1). In 1992 *ESM* grew again to two volumes of 4 issues each per year. This increased workload called for an addition to the editorial team, and in 1994 Kenneth Ruthven joined the other editors (Dörfler, 1994, p. iii).

Though *ESM* was well established among mathematics educators by the time Dörfler took on its stewardship, its character had been a direct reflection of the first two editors, Freudenthal and Bishop. To ensure long-term

continuity and consistency, Dörfler reduced the dependence on a particular editor by making editorial practices clear and explicit and by addressing the size and composition of the editorial team and board. These changes also enabled *ESM* to handle the increased workload as it grew to reflect the expanding discipline of mathematics education. Willi Dörfler edited the journal for six years, from 1990 to 1996, and oversaw the publication of Volumes 21 to 29.

2.4. *Ruthven*

In 1996 Dörfler was replaced by Kenneth Ruthven. By the time he took over *ESM*, as Ruthven would later say, "it had taken on a well established character as an academic periodical."[15] Again the transition was a smooth one for the editorial team and board. Ruthven had already been a member of the editorial team, Gila Hanna and Leen Streefland stayed on as co-editors, and Dörfler became an advisory editor along with Bishop. The editorial board, which had already grown during Dörfler's term, gained members and enjoyed an even greater national spread.[16]

Since *ESM* had always endeavoured to be genuinely international, Ruthven addressed this issue in his first editorial with some rough statistics on the situation at the time and an expression of hope that the journal would receive submissions from a wider range of countries in the future. In 1996, he wrote:

> Over the last two years, contributions to the journal... have come from around 30 countries, spanning the six major continents. During this period, nevertheless, around three-quarters of the articles have originated in six countries – USA, UK, Israel, Australia, Germany and Canada – with the remainder primarily from other western countries. This is a distribution which reflects the current pattern of submissions to the journal, but one which we would like to see shifting in response to an increasing volume of proposals from a wider range of countries.
>
> (Ruthven, 1996a, p. 1–2)

Early in his term of office, Ruthven asked the editorial board to review the journal's language policy, which then, as now, was to publish papers in either English or French. This stimulated considerable discussion, with around half the board supporting the idea of publishing in English only, principally on the grounds that English was already in effect the international language of the field. The remainder expressed some degree of reservation about moving to a monolingual policy, although many of those believed that growing recognition of the need to publish in English in order to reach a wider audience would tend to further reduce the number of submissions in French. The value of retaining French was seen as one of maintaining greater diversity of ideas and cultures, although the correspondingly extended view that the journal should publish work in other

languages was very much a minority one. In the light of this range of often strongly held opinion it was decided to maintain the established policy.

Under Ruthven it was decided that the criteria for the suitability of papers should be made explicit in "Advice to Prospective Authors," a notice that is still found at the beginning of every volume of *ESM*. Authors are told, for instance, that they should make the significance of their work clear, that their work should be of more than local interest, that their theory and method should be made explicit, and that their work should show awareness of other relevant work and be embedded in existing research (Ruthven, 1996b, p. 3).

Many of these criteria had been foreshadowed in Dörfler's talk on quality criteria, but they were now addressed openly to *ESM* readers and authors. The editors also used this occasion to state their broader goals, writing that *ESM* "aims to illuminate issues of principle, policy and practice in the field, and to promote the development of coherent bodies of theorised knowledge which can be brought to bear on these issues." (Ruthven, 1996b, p. 3) By setting out the journal's criteria and goals explicitly, the editors hoped to improve the quality and suitability of submissions and thus lighten the task of controlling the quality of *ESM* and shaping its direction.

During Ruthven's tenure there were significant changes in his editorial team. In 1997, when the publication programme increased to three volumes per year, Tommy Dreyfus became an editor. Already fighting the illness that would claim him the following year, Leen Streefland resigned as editor in 1998 and Heinz Steinbring took his place. In 2000 Gila Hanna stepped down as editor, to be replaced by Norma Presmeg. To provide continuity when Ruthven turned over responsibility for the journal to Anna Sierpinska in 2001, the outgoing and incoming editors-in-chief worked in tandem for nearly a year.

In 2000 the publication schedule was again expanded, with the addition of two special issues on research themes from the annual meeting of the International Group for the Psychology of Mathematics Education (PME), edited by PME members. This met a longstanding aspiration of PME to see wider dissemination of high quality work presented at its conferences, and enabled *ESM* to extend its programme of thematic special issues (Ruthven, 2000a).

ESM continued to grow during Ruthven's term as editor. More papers were submitted, but their breakdown by national origin remained about the same. Ruthven had wanted to see the national representation of papers broadened, as mentioned, and in his last editorial he again expressed this desire:

> What I wrote in 1995 could largely be repeated in respect of the ensuing five years. As then, I can record that around three quarters of published articles have originated in six countries, with the leading five – USA, UK, Israel, Australia and Canada – retaining their positions in that group. One promising development is the rise of collaborative authorship across countries; this appears to have potential in strengthening representation beyond the predominantly North American, Western European and Australasian provenance of papers published in the journal.
> (Ruthven, 2000b, p. 223–224)

As he had in his opening editorial, Ruthven used his closing editorial to give voice to his views on the character he would like to see *ESM* assume. In his final comments he gave a short critique of the journal during his editorship, referring to key issues he had identified at the start of his term:

> While the journal continues to be successful in attracting papers which grapple with substantial educational issues in ways which are sensitive to the distinctive textures of mathematics, the proportion of submissions which focus explicitly on central activities of teaching remains disappointing. Similarly, while papers are generally effective in building on particular lines of work, it is much rarer for submissions to take account of different perspectives and variant approaches.
> (Ruthven, 2000b, p. 223)

Earlier in his tenure Ruthven had invited short communications on issues raised in papers that had appeared and had also sought to reshape the book reviews into analytical essays. His closing comments appraised the contribution of these innovations:

> It has been particularly gratifying when readers and authors have been willing to enter into public dialogue; for example, over didactical analyses of group theory (see 31/4 and 34/3) or function definition (see 33/3). As a researcher, I consider such exchanges particularly valuable for development of the field; and as a teacher, I find that they can be particularly illuminating to students in the process of entering the field. Good book reviews, written from a stance of critical appreciation, can make a similar contribution, and the journal has been fortunate in this respect too. (Ruthven, 2000b, p. 223)

Those who have served as editors, editors-in-chief or book review editors, of *ESM* are listed in Table I.

3. Increased emphasis on research papers

In the beginning *ESM* aimed at disseminating information on activities in mathematics education taking place in the various countries and at improving international co-operation on that subject. To understand how it evolved into a journal that puts great emphasis on research papers, one has to look at the changes in mathematics education research over the same period.

TABLE I

List of ESM editors

ESM editors and book review editors	
Editor: Hans Freudenthal	1968–1977
Editor: Alan Bishop	1978–1989
Book review editors: Erich Wittmann	1981–1985
Christine Keitel	1986–1992
Editor-in-Chief: Willibald Dörfler	1990–1996
Editors: Gila Hanna	1990–2000
Leen Streefland	1990–1998
Kenneth Ruthven	1994–1996
Book review editor: Celia Hoyles	1992–
Editor-in-Chief: Kenneth Ruthven	1996–2001
Editors: Tommy Dreyfus	1997–
Heinz Steinbring	1998–
Norma Presmeg	2000–
Editor-in-Chief: Anna Sierpinska	2001–

Since the turn of the century, mathematics education research had attempted to establish itself as a scientific discipline, with some degree of success (Kilpatrick, 1992). Of particular relevance to the history of *ESM* are developments since the late sixties, when *ESM* was launched. These last four decades witnessed a surge of activity in mathematics education, starting with the curriculum projects that became known as "the new math" and with the novel collaboration of psychologists and mathematicians on curriculum development that introduced new teaching methods and new concepts such as "learning by discovery" and "readiness for learning" (Howson, Keitel and Kilpatrick, 1981; Gagné, 1968; Shulman, 1970).

The late sixties and the seventies also saw the creation of several organisations for researchers in mathematics education. In the United States, the Special Interest Group for Research in Mathematics Education (SIG/RME) met for the first time at the American Educational Research Association (AERA) in 1968 (Kilpatrick, 1992). Over 20 regional research and development centres were established in the United States alone between 1965 and 1967 (Kilpatrick, 1992).

In Europe there was also a great deal of activity. Some 30 *Instituts de Recherche pour l'Enseignement des Mathématiques* (IREM) were established in France, starting in 1969. In the Netherlands the IOWO (In-

stituut Ontwikkeling Wiskundeonderwijs, or Institute for development of mathematics education), now called the Freudenthal Institute (FI) was set up in 1971. The *Institut für Didaktik der Mathematik* (IDM) in Bielefeld, Germany, began its work in 1973. Two Shell Centres for Mathematical Education were set up in 1968 in the United Kingdom. In 1977 the Canadian Mathematics Education Study Group (CMESG) was founded (Wheeler, 1992), and in the same year the Mathematics Education Research Group of Australia (later changed to Australasia), known as MERGA, convened its first conference (Clements and Foyster, 1977).

Several surveys of mathematics achievement were also carried out on both sides of the Atlantic (Husén, 1967; Dossey, Mullis, Lindquist and Chambers, 1988). By far the most comprehensive were the three international comparisons of achievement carried out over the last four decades by the International Association for the Evaluation of Educational Achievement (IEA). The First (FIMS), Second (SIMS), and Third (TIMSS) International Mathematics Studies started collecting data in 1964, 1980 and 1995 respectively, and have reported on several aspects of mathematics achievement and curricula in some 40 countries.

In addition, the international community of researchers in mathematics education has grown markedly since the launching of *ESM* in 1968, holding several international conferences each year and publishing specialised newsletters and journals. From 1960 to 2000, an average of 30 such new journals have arrived on the scene every ten years, bringing the number of refereed journals that publish mathematics education research papers to over 675. Several of them are now available on the Web as free electronic journals (Hanna, 2000; Schubring, 1980).

It was in response to this ferment in mathematics education, and in particular to the growing number of researchers and research activities, that *Educational Studies in Mathematics*, seeking to reflect the interests of its readers and provide a forum for their work, gradually assumed the form of a refereed journal. Today *ESM* is one of the major journals in its field, reaching thousands of readers through institutional subscriptions all over the globe. Its readers see it as playing an important role in advancing the art and science of mathematics education. They look to it for intellectual leadership, for new ideas that would affect their own thinking and for solutions to problems of classroom teaching.

ESM does not differ from other scholarly journals, however, in that the papers submitted reflect primarily the current interests of individual researchers. This is one of its strengths, of course, in that it allows it to make the results of current research available to its readers, but, as with other journals, it is also a limitation. Indeed, as Bauersfeld (1997) has

observed, individual researchers' agendas do not necessarily constitute systematic attempts to define and address problems of great significance to mathematics education, but rather

> Too often the choice of a research agenda follows actual models, easily available methods, and local preferences rather than an engagement in hot problems that may require unpleasant, arduous, and time-intensive investigations.
>
> (Bauersfeld, 1997, p. 621)

4. A PROFILE OF *ESM* ARTICLES BY CONTENT AREA, EDUCATIONAL ISSUE, LEVEL OF SCHOOLING AND RESEARCH METHOD

This part of the paper will look at the breakdown of *ESM* articles over the years in some detail from the points of view of the content area, the educational issue and the level of schooling discussed, as well as the research method employed. The primary tool was the database maintained by the Educational Resources Information Center (ERIC), which is discussed in some detail later, and the focus of the statistical analysis was upon the years beginning with 1970, which are fully represented in that database.

In its first two years, 1968 and 1969, *ESM* published 85 papers in two volumes, but only nine of them are included in the ERIC database. For that reason these two formative years are treated here separately, and the following comments are descriptive rather than statistical.

4.1. *Volume 1*

A total of 48 papers were published in the four issues that made up the first *ESM* volume, 32 in English, 15 in French and one in German.

The first two issues of Volume 1 were devoted to the proceedings of the colloquium on "How to teach mathematics so as to be useful", held in Utrecht in 1967. The purpose of this colloquium was to search for ways to design a school mathematics curriculum that would put more emphasis on teaching students to apply mathematics to real life situations.

Not surprisingly, none of the papers in the first two issues originated in educational research as we understand it today. Most were either essays on the teaching of mathematics, or informational papers reporting on mathematics education in different countries. Interestingly, they varied wildly in length from one page to 35, with the average being about nine pages, which is far less than today's *ESM* average of about 17 pages. The list of authors reads like a *Who's Who* of mathematics and mathematics education, and includes such well-known figures as Krygowska, Fletcher, Freudenthal, Griffiths, Pollak, Revuz, Servais and Steiner. The countries represented at

the colloquium, and thus in the papers, were Belgium, France, Germany, Poland, Switzerland, the Netherlands, the UK and the USA.

Understandably, most of the papers were very focussed on the theme of the colloquium, as the following titles would indicate: "On some of the problems of teaching applications of mathematics", "Comment enseigner la mathématique pour qu'elle soit utile? Problématique et axiomatique" and "Applied mathematics in English schools". Other titles, however, are more revealing of the prevailing mood among the participants as to the state of mathematics education in 1968, and carry such colourful titles as: "On the enfeeblement of mathematical skills by modern mathematics and by similar soft intellectual trash in schools and universities" and "Les pièges de l'enseignement des mathématiques".

Issues two and three of Volume 1 also consisted of relatively short papers, with an average length of about eight pages. Some ten of the 32 papers were informational, with titles such as: "The CSMP approach to a content-oriented, highly individualized mathematics education", "Expérimentation d'un enseignement des mathématiques en classe de sixième des lycées et collèges", "Applied mathematics in English schools" and "Une expérience d'enseignement de mathématique avec des enfants de 11 à 13 ans".

In the other 22 or so papers, the major themes discussed were set theory and Venn diagrams (4 papers) and geometry (3). Interestingly enough, some of the authors wrote more than one paper: four papers were by Freudenthal, three by Steiner, two by Castelnuovo and two by Kaufman.

The proportion of informational articles in the first two issues is strikingly high. One must remember, though, that in 1968 research in mathematics was still in its infancy, and that in any case a stress on information exchange was entirely in line with Freudenthal's intentions. He had seen little exchange of information on activities in mathematics education in and among various countries, and had wished to make *ESM* a vehicle for its dissemination.

The lack of information exchange was seen as having deleterious consequences for thinking on mathematics education. Geoffrey Howson, commenting on the journal *L'Enseignement Mathématique*, had made the point that articles on mathematics education tended to be written at the time by distinguished mathematicians who made pronouncements without really knowing what was happening in schools. Howson (2000) adds that

> Many of the papers were, in the words of Freudenthal, the equivalent of publishing theorems without proofs, for ideas were never worked out in a form that could be used in classrooms (or would fit naturally within a school curriculum). Nevertheless, the concern of the mathematicians and the professional strength of a considerable proportion of schoolteachers in that period did lead to some

extremely good and impressive mathematical writing – even if on many occasions this also demonstrated either a lack of pedagogical understanding or ill-founded optimism. (Howson, 2000, p. 1)

4.2. *Volume 2*

Volume 2 of *ESM* consisted of 37 papers (25 in English and 12 in French), of which 20 had been presented by prominent mathematicians or mathematics educators at the first International Congress on Mathematical Education (ICME) that took place in Lyons in August 1969.

Only one of the other 17 other papers was an informational one, bearing the interesting title "Sweep away all cows, ghosts, dragons, and devils: A report on the effects of the cultural revolution on mathematics education in China". The remaining 16 papers not from the ICME addressed various issues, such as teacher education, the development of self-reliant thinking and the relative effectiveness of different teaching techniques in large college classes.

Among the authors of the 20 ICME papers were Armitage, Begle, Christiansen, Fischbein, Markouchevitch, Papy and Thwaites. Most of these papers discussed the teaching of applications or the teaching of topics such as addition and subtraction, geometry, probability, vectors, and sets and logic. Among the papers, however, were a few that addressed research in mathematics education.

Most noteworthy of the latter is the paper by E.G. Begle, then director of the influential School Mathematics Study Group (SMSG) project in the USA. This 12-page paper, entitled "The role of research in the improvement of mathematics education", appeared in issue 2/3 (pp. 232–244). It is the first *ESM* article to discuss the emergence of mathematics education as a research discipline and the potential relevance of systematic research to mathematics teaching. In it Begle made two main points: 1) there is a factual aspect to mathematics education, in that most questions can be answered by examining real classroom situations, and 2) this factual aspect has been badly neglected, in that "most of the answers we have been provided have generally had little empirical justification" (p. 233).

In his paper, Begle advocated the use of experimental designs, standardized tests and hypothesis testing in mathematics education research. In Europe such quantitative methods had never taken hold, and it was partly for this reason that *ESM* seldom published research papers based on experimental methods and statistical analyses. In the USA, however, the use of quantitative methods, including statistics, psychometrics and measurement, did gain popularity in the seventies and eighties, due to the influence of Begle and others. Though the quantitative approach was all but

abandoned in the nineties as ineffective (Sierpinska and Kilpatrick, 1998), Begle's *ESM* paper was an important landmark in mathematics education, in that it established the need for the systematic investigation of teaching and learning at a time when no such thing existed.

It is also noteworthy that of the 37 papers in Volume 2 there were three on the use of technology in mathematics education, with the following titles: "The role of the computer in school mathematics", "Problem-solving on a computer-based teletype" and "Minicomputers".

4.3. *The years 1970–1999: Analysis of data from the ERIC database*

The Educational Resources Information Center (ERIC) was created in 1966 to collect, organize, and disseminate information in the field of education, and its database is the world's largest single source of such information. The ERIC database indexes articles (also referred to here as papers) from more than 900 journals, and provides titles, abstracts and other information for each such article. All *ESM* journal articles that appeared in English from 1970 are included in the ERIC database, and form the data used in this study.

The ERIC database also includes some *ESM* articles that appeared before 1970, as mentioned earlier, as well as some *ESM* articles in French, but these two categories were excluded from our study because their data is incomplete. The years after 1999 were also excluded, because the information was not yet in the database.

When an article is entered into the database, ERIC assigns to it one or more indexing terms, also known as descriptors or keywords. For more recent articles, the descriptors are the keywords provided by the authors, while for earlier articles without imbedded keywords the descriptors were assigned by ERIC on the basis of a perusal of the title and the abstract of the paper. An ERIC search must make use of these descriptors, but logical operators such as AND and OR can be used in various combinations to narrow or expand the search.[17]

Table II shows the number of papers published by *ESM*, by decade, compared to the overall number of papers on mathematics education published in all the journals represented in the ERIC database. The number of papers in all journals was obtained by searching ERIC for articles bearing either or both of the two descriptors 'Mathematics Education' or 'Mathematics Instruction'. Not surprisingly, Table II indicates that papers on mathematics education are published in many different journals.

TABLE II

Number of papers on mathematics education by decade in ESM and in all journals

	1970–79	1980–89	1990–99	Total
ESM	170	206	337	713
All Journals	7,499	8,460	10,211	26,170

4.3.1. *Breakdown by content area*

A search was performed to determine the approximate distribution of *ESM* papers by content area. The nine content areas initially considered were those used by *ESM* when it assigns submissions to reviewers based upon their content (*ESM* internal document): 1) Number / calculation, 2) Algebra, 3) Geometry / space, 4) Statistics / probability, 5) Discrete mathematics, 6) Functions / calculus, 7) Problem Solving, 8) Proving, 9) Modelling. The area of Discrete mathematics was later dropped because almost no papers were represented. The final list was thus made up of 8 content areas.

Each of these content areas was then assigned a number of descriptors, and these descriptors were used for the actual search. The descriptors used for Geometry, for example, were 'geomet*' (where '*' is a wild card), 'space', and 'spatial'.

It was expected that some *ESM* papers would not fall into any of these content areas, but the papers that did belong to at least one of these areas were found to account for 85.3% of all *ESM* papers in the decade 1970–79, 62.1% in 1980–1989 and as many as 85.8% in 1990–1999.

It should be kept in mind that these content areas are not mutually exclusive, so that a paper may fall into two or more areas. This does not affect the validity of the individual percentages shown by area, since a paper cannot be counted more than once for a given content area. Since a paper may contribute more than once to the overall number, however, it does mean that the total of these percentages (as given earlier in this paragraph) may overestimate the proportion of ESM papers that fall into at least one of the 8 content areas.

To determine the relative representation of content areas in *ESM* by decade, the papers were first tallied by area and by decade. Table III shows, by decade, the number of papers that fell into each of the content areas followed by the total number of papers that appeared in English in *ESM*.

TABLE III

Number of papers published in *ESM* by decade and by content area in descending order for the first decade

Content area	1970–79	1980–89	1990–99	Total
Geometry or space	55	23	49	127
Problem Solving	20	48	62	130
Algebra	15	7	28	50
Modelling	14	9	18	44
Functions or calculus	13	6	25	65
Number or calculation	11	23	31	35
Proof	9	4	22	30
Statistics or probability	8	8	14	75
Total for 8 content areas	145	128	249	556
Total # of papers in ESM	170	206	337	713

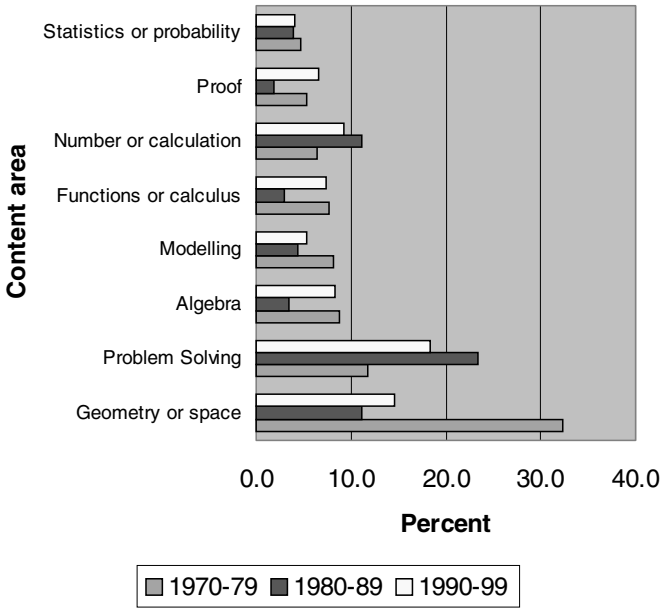

Figure 1. Percent of papers by content area and by decade.

For each decade, the number of papers in each content area was then divided by the total number of papers to give a percentage. Figure 1 shows the resulting distribution by content area and by decade.

It is striking, though not surprising, that in the decade 1970–79 over 30% of the papers published in *ESM* discussed geometry, and this is certainly a reflection of the importance Freudenthal accorded to this topic. The dominant content area in the next two decades, 1980–89 and 1990–99, was Problem Solving, accounting for close to 25% and 18% respectively of all *ESM* papers. Again, this is not surprising, given that issues of problem solving were quite prominent in mathematics education at the time (Kilpatrick, 1992).

In 1980–89 the second highest proportion of papers was in the content areas of Geometry and Number or Calculation, with close to 12% of all ESM papers. In 1990–1999, the second highest proportion of papers was in the area of Geometry, with close to 15% of the papers.

4.3.2. *Breakdown by educational issue*

A second search was then performed to determine the approximate distribution of *ESM* papers by issue under discussion. The 15 issue categories initially considered were those defined over the past five years by the editors of *ESM* for the purpose of assigning papers to reviewers (*ESM* internal document): 1) Affective issues, 2) Cognitive issues, 3) Epistemological issues, 4) Didactical issues, 5) Pedagogical issues, 6) Reform and Curricular issues, 7) Social & Cultural issues, 8) Historical analyses, 9) Technology, 10) Language, 11) Imagery / visualization, 12) Gender / ethnicity, 13) Methodology (qualitative), 14) Methodology (quantitative), and 15) Assessment.

In view of preliminary ERIC results, two changes were made in this list, reducing it to 11 issue categories. The Didactical and Pedagogical categories were combined (so the final search was carried out with the descriptor combination 'didact* or pedagog*'). The last three issue categories, Methodology (qualitative), Methodology (quantitative) and Assessment, were deleted altogether because they yielded very few articles or none at all. This is probably because the first two terms are seldom used as keywords in papers, and because it is only recently that the term 'assessment' has appeared as a keyword.

The category names that appear in the table are shortened forms. The label 'Gender' stands for the category 'Gender / ethnicity' and the label 'Social' stands for 'Social & Cultural issues'.

The issue categories listed above were chosen relatively recently by the editors of *ESM* to reflect the issues dealt with in papers submitted to *ESM*

and the issues thought by the editors to be most relevant to current research in mathematics education. Clearly, these current issues are not necessarily those that were high on the agenda of researchers one or two decades ago. Indeed, the ERIC search shows that only 35.9% of the papers published in 1970–79 addressed any of these issues. This percentage was as high as 77.2% for the years 1980–89, however, and reached 97.6% in the years 1990–99 (see Figure 2).

Like the content areas discussed earlier, these 11 issue categories are not mutually exclusive, so that a paper may fall into two or more categories. Accordingly, the total percentages given in the previous paragraph may somewhat overestimate the proportion of *ESM* papers that addressed at least one of these issues.

Cognitive issues, which had already attracted fairly significant attention in the decade 1970–79, became dominant in the later decades 1980–89 and 1990–99, where they accounted for over 29% and over 32% respectively of all *ESM* papers.

Like Cognitive issues, Social issues showed a steady growth in relative weight over the three decades. Concern for social issues in the teaching and learning of mathematics, as reflected in *ESM*, had been almost non-existent in the first decade, but rose to just under 11% by 1980–89 and then to almost 15% by 1990–99. It is also notable that the issue of gender and ethnicity, which accounted for just over 4% of the papers in the first decade of *ESM*, rose to over 11% in 1980–89, but then dropped back to a little under 6% in 1990–1999.

4.3.3. *Breakdown by level of schooling*

A third search was then performed to determine the approximate distribution of *ESM* papers by level of schooling. Four categories were determined, of which three represented the universally accepted classification of formal education into ‘primary or elementary’, ‘secondary’ and ‘tertiary’, while the fourth represented informal education, with the label ‘adult education’. ‘Primary or elementary’ refers to schooling from kindergarten to about grade 8 or ages 5 to 13, ‘secondary’ refers to grades 9 to 12 or ages 13 to 19, and ‘college or university’ refers to formal tertiary education.

The number of papers falling into each of the four levels was determined by a search of the ERIC database using appropriate combinations of keywords. Like the categories used in the two ERIC searches discussed earlier, these four levels of schooling are not mutually exclusive.

Indeed, a sufficient number of papers fell into two or more categories to cause the totals of the four levels to account for over 100% of all the papers in each of the three decades: 126.5% in the years 1970–79, 120.9%

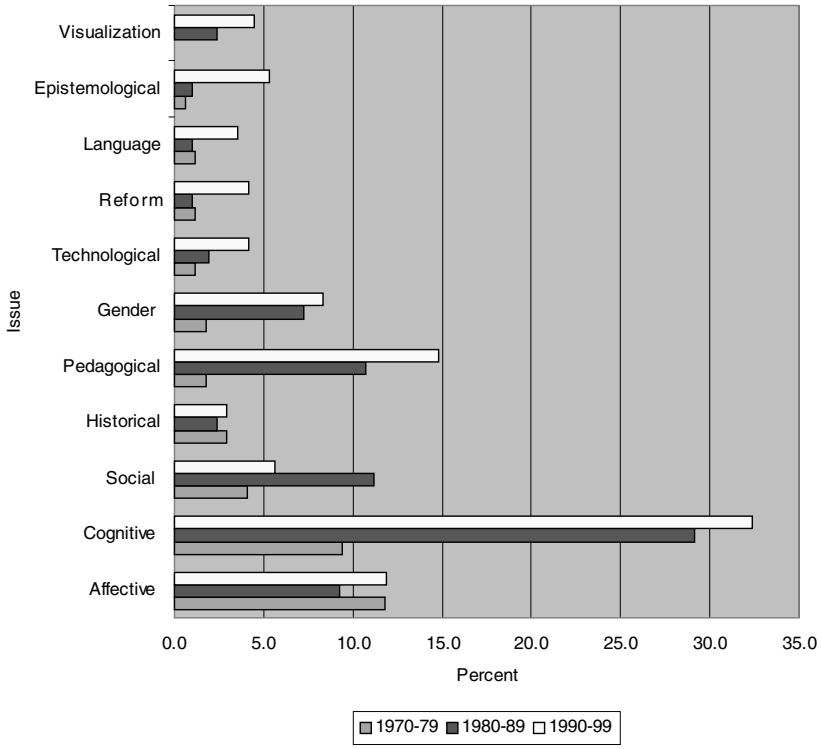

Figure 2. Percent of papers by issue and by decade.

in 1980–89 and 117.8% in 1990–1999. Nevertheless, the data show that from its inception *ESM* has consistently paid more attention to mathematics education at both the elementary and secondary levels than at the tertiary level (see Figure 3).

4.3.4. *Breakdown by research method*

Providing a breakdown by research method is far from straightforward. ERIC's keywords and descriptors for *ESM* articles tend to refer to topics rather than to research methods. To determine the frequency of use of various research methods over the life of *ESM* would thus have set the impossible task of reading every one of 713 papers, or at the very least every abstract. Because of time constraints we provide a breakdown by research method only from Volume 21 through the first issue of Volume 35, which fall in the years 1990–98.

The 274 articles examined were first sorted into two broad categories of research paradigm: analytical and empirical. In the first category there were 63 papers (about 23%), addressing topics such as epistemology, history and philosophy. Examples of such papers are, "*Mathematical*

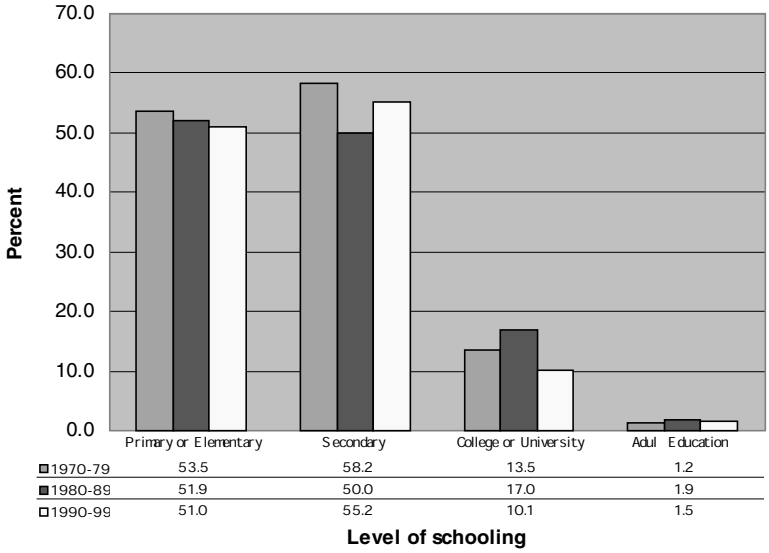

Figure 3. Percent of papers by level of schooling and by decade.

Knowledge and the Problem of Proof" by M. Otte (1994, ESM 26 (4), 299–321), "*Mathematical Education and Democracy"* by O. Skovsmose (1990, ESM 21 (2), 109–28), and "*On Mathematics Education and Culture: Critical Afterthoughts"* by Y. Chevallard (1990, ESM, 21 (1), 3–27). These papers were not studied further and are not represented in Figure 4.

The 211 papers that discussed empirical research were assigned to one or more research methods such as "hypothesis testing", "action research", "observations" and "content analysis" (Gall, Borg and Gall, 1996). Those methods represented by fewer than three papers, such as 'causal modelling' and 'reflection results', were eliminated, leaving the 12 methods shown in Figure 4. (The papers that did not fall into any of these final 12 research categories, and so were eliminated from further consideration, made up about 20% of the total.)

Figure 4 shows that as many as 20% of empirical studies make use of interviews, whereas as few as 4% make use of hypothesis testing, cross-cultural studies or surveys.

5. Special Issues and Guest Editors

It was Freudenthal's hope, a hope shared by *ESM's* subsequent editors, that the journal would become vital to the international mathematics education community. There were a number of ways in which the journal was directed towards this end. As well as providing a venue for papers of more than

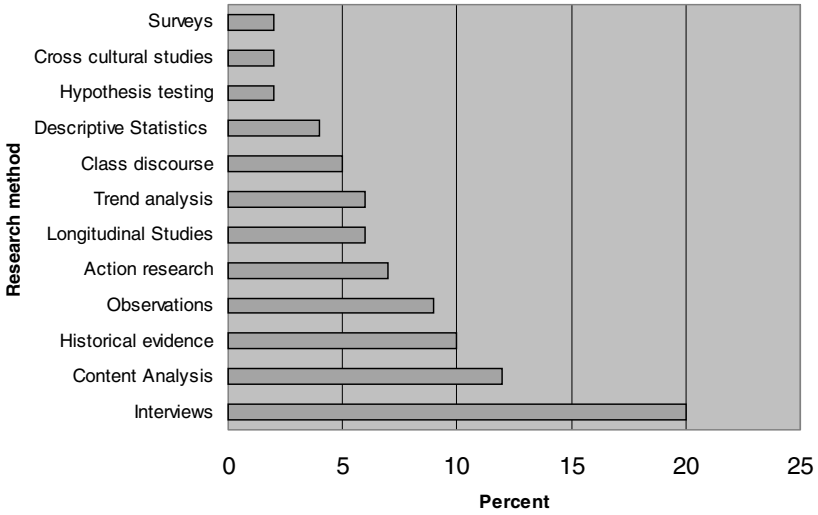

Figure 4. Percent of papers by research method, 1990–1998.

national interest, the journal initially published the proceedings of international mathematics education conferences; eventually it chose to address topics that were of concern to the worldwide discipline of mathematics education through special issues.

The goal of the special issues was not to offer a comprehensive overview or a systematic exposition of the state of the art, but rather to present examples of current research methods and various critical and theoretical approaches. In general, the editors of the special issues seem to have had a preference for work that was innovative and challenging to conventional discourse. They were also concerned to bring forward work that was not yet well known to the international community of mathematics education researchers.

Freudenthal was especially interested in publishing the proceedings of international conferences. As already mentioned, *ESM* began with the proceedings of an ICMI conference. The 3rd issue of Volume 3 and the 1st issue of Volume 4 were devoted to the proceedings of a conference of the Comprehensive School Mathematics Program (CSMP). These proceedings were introduced with a few pages written by Burt Kaufman that served as a sort of guest editorial (Kaufman, 1971). There is no reason to assume that Kaufman took over any of the editorial responsibility for these issues, but the format was a first step in the direction of using guest editors.

As we have seen, Bishop was the first to bring in a guest editor to put together a special issue on a single topic (Leder, 1986), and he continued to do so off and on. Dörfler acknowledged the benefit of such special issues

and made them more frequent and more regular (Dörfler, 1993a). Ruthven later tied the concept of topical special issues to the earlier attention to conference proceedings, announcing the introduction of special issues devoted to research themes addressed at the annual meeting of the PME (Ruthven, 2000). (Though they often were built upon work presented at PME, the articles published in such special issues were not taken from the proceedings, but rather submitted and refereed in the normal manner.)

To provide us with additional insight into how *ESM* has positioned itself in the field of mathematics education, we will look at the topics covered in the special issues since Bishop assumed the editorship of *ESM*.

The first two special issues dealt with the topics of mathematically able and mathematically disadvantaged students respectively; the first was edited by Gilah Leder, the second by Josette Adda. A theme that ran through many of the papers in both special issues was that of the terms themselves. In fact, in Adda's editorial for the issue on disadvantaged students the author is so wary of using any label that it takes a thorough perusal of the editorial to determine what the special issue is about (Adda, 1987). Both special issues examined the standards and procedures, with their potential socio-political bias, by which educators sort students into groups of differing mathematical ability, as well as the effects of such selection on the students themselves.

In 1988, Allan Bishop himself edited a special issue titled *Socio-cultural Studies in Mathematics Education*. In his editorial Bishop acknowledged the growing role of the social sciences in mathematics education. He pointed out that the previous ten years had been marked by increased attention to the effect of social forces on mathematics learning, in the same way as the previous decade had been marked by increased attention to psychological forces. This trend to a socio-cultural view was not without controversy; while he acknowledged this, Bishop thought that the quantity of research embodying such a view was cause for special treatment.

In the next year, Kenneth Ruthven edited his first issue of *ESM*, a special issue on information technology in mathematics education. Information technology, then as now, was developing so rapidly that it was difficult to keep abreast. Ruthven, in his guest editorial, pointed out that much of the previous work on information technology in the mathematics classroom had been largely conjectural (Ruthven, 1989). This special issue of *ESM* surveyed the rapidly changing field and presented research then current in computer-aided instruction and in the use of mathematical programming in education.

Colette Laborde edited the first special issue published during Dörfler's term as editor in 1992. It dealt with the theory and practice of classroom

dynamics. Laborde, in her guest editorial, made clear her view that the role of mathematics education is not to propose new teaching strategies but to study the processes that actually occur in the classroom. The papers in this issue addressed two types of question: 1) "the construction and organization of pupil's activities favoring a previously determined learning outcome," and 2) "the role of pedagogical interventions of the teacher." (Laborde, 1992).

The growing popularity of constructivism prompted *ESM* to put out a special issue devoted to this topic in 1992. In editing this issue, Ernst von Glasersfeld took care to choose papers that not only clarified the constructivist orientation in didactics, but also tried to show how constructivism can be a useful model in practice for mathematics education. As he says in his editorial, one of the strongest criticisms against radical constructivism is that "it has little to offer the teaching practice of schools."(von Glasersfeld, 1992). The papers in this issue of *ESM* attempt, not only to help teachers gain insight into the conceptual world of their students, but also to show why such insight is necessary.

In 1993, Alan Bell edited a special issue devoted to design in teaching that came out of a working group of the PME. This working group brought together researchers from a number of European and North American countries, all concerned primarily with curriculum development, with the aim of determining to what extent general principles of teaching design could be established. This issue of *ESM* was a continuation of the book *The Design of Teaching – Papers from PME Working Group* (Bell et al., 1988). The papers present research of three different kinds: 1) studies of the psychological aspects of learning, 2) studies of iterative design and development, and 3) comparative studies of the same topic taught through different methods (Bell, 1993).

Also in 1993, Gila Hanna and H. Niels Jahnke edited a special issue on the role of proof in mathematics and mathematics education. To get at the wide range of questions involved, the editors asked for papers "dealing with historical and epistemological aspects of proof, with standards of mathematical argumentation, and with topics of current debate such as convincingness, perspicacity, computer-assisted proof, and the relationship between intuition and logic."(Hanna and Jahnke, 1993). The papers published were mostly historical, cultural and epistemological studies of the role of proof and argumentation, although one dealt with the use of proof in the mathematics classroom.

The final special issue of 1993 commemorated the legacy of Freudenthal. Leen Streefland wrote an editorial which introduced Freudenthal the man through biography and anecdote as it described the papers in the issue,

which dealt with all aspects of Freudenthal's impressive career (Streefland, 1993).

In 1994, Paul Cobb edited a special issue that addressed theories of mathematical learning. Most of the papers took a cognitive view, analyzing classroom processes from an internal perspective. These papers study the ways in which students and teachers modify their own activity and understanding throughout the course of a classroom process. One of the papers viewed the process from an interactionist perspective, taking the view of an outside observer watching a complex social interaction. From this perspective, the objects of study become the meanings that teachers and students assume to be common and the ways in which they negotiate these meanings. In his editorial, Cobb (1994) took care to point out the ways in which these two positions, the cognitive and the interactionist, have 'complementarity.'

The second special issue that appeared in 1994 was on the relationship between assessment and the learning of mathematics. This issue attempted to address the growing gap between the value placed on assessment for political reasons on the one hand and for educational reasons on the other. Leone Burton, who edited this issue, invited authors to submit papers on assessment that addressed innovations and alternative styles. As she made clear in her introductory remarks, the authors in this issue evinced discomfort with traditional styles of assessment (Burton, 1994). They also made the case that alternative styles of assessment can produce more useful information about mathematics learning.

Another special issue that had its origins in a PME working group appeared in 1995. Tommy Dreyfus edited an issue of *ESM* following up on the book *Advanced Mathematical Thinking,* which had presented the earlier work of the same working group (Tall, 1991). Because the authors assumed the reader was familiar with this text, the issue began with an essay review. The four papers which followed all dealt with advanced mathematical thinking at the tertiary level (Dreyfus, 1995).

In the same year, Gilah Leder edited a special issue on gender concerns in mathematics education. In her editorial, Leder located the research presented in this issue within the context of the now standard breakdown of feminism into three waves. She pointed out, however, that research guided by the assumptions and concerns of previous generations is still of value in studying gender issues in the mathematics classroom. The papers in this issue demonstrated the diversity of the theoretical approaches that were considered valuable when the issue was put together.

In the following year, Stephen Lerman edited a special issue of *ESM* devoted to research into the socio-cultural context of mathematics education.

This issue addressed the growing interest in the socio-cultural construction of the education process, an interest that had also been recognized the year before as the theme of the annual meeting of the PME. As Lerman (1996) explained in his editorial, the papers in this issue took a variety of theoretical approaches to address directly the ways in which socio-cultural contexts constitute and control individuals as learners and teachers.

Richard Noss edited an issue on the computer in mathematics education in 1997. In his editorial Noss (1997) indicated four themes that ran through the included papers: 1) the computer as a means of studying mathematical expression, 2) the computer as productive of insight into mathematical epistemology, 3) the development of a close relationship with mathematical meaning made possible through the computer, and 4) the use of computers in the design phase of research on mathematics pedagogies. The aim of this issue was to bring researchers in computers and mathematics and researchers in mathematics education closer together.

Another special issue of *ESM* which arose out of a PME working group appeared in 1999. Dina Tirosh edited a volume called *Forms of Mathematical Knowledge: Learning and Teaching with Understanding*. The papers were split into two groups. The first group consisted of papers that defined and described various forms of mathematical knowing and discussed some implications of these for mathematics education. The papers in the second group treated in similar ways the various forms of knowledge that are necessary to teaching, those which are mathematical as well as those which are not.

Again in 1999, Paolo Boero edited a special issue of *ESM* under the title 'Teaching and Learning in Context.' In his editorial, Boero distinguished between two senses of the word 'context' in mathematics education: the socio-cultural context and the use of context-rich problems as a motivation for learning. Although he made it clear that most of the papers in this issue dealt with the second topic, a few of them did have interesting things to say about context in the first sense of the term.

The last special issue which we will mention here was the first of the PME special issue series. Although *ESM* had already published special issues that had originated in PME working groups, this was the first one published after Ruthven had formalized this arrangement with the promise of two annual PME special issues. This first PME special issue was edited by Keith Jones, Ángel Gutiérrez and Maria A. Mariotti, and dealt with the "influence of dynamic geometry software on students' conceptions of mathematical proof." (Jones, Gutiérrez, and Mariotti, 2000).

6. By way of conclusion

We are aware that in telling the story of *ESM* we have barely touched upon its influence and its rich history. It is not hard to think of aspects of *ESM* that have not been discussed. It would be interesting above all, though such an assessment would no doubt be difficult, to know just what impact *ESM* has had on mathematics education at the various levels of schooling. Many other questions come to mind. Are *ESM* papers used regularly in graduate courses? Have they attracted a great deal of attention internationally? Has *ESM* put too much emphasis on publishing research? What role has *ESM* played in shaping theories of mathematics education? We very much hope that others will take on the challenge of addressing such questions and describing the many aspects of *ESM* that this article has not captured.

ESM didn't just happen. It was the brain child of Freudenthal, who nurtured it and brought it to the point where it was a leading journal in its field. His successors were certainly able to keep it in this leading position and make it a journal that affects both the teaching of mathematics and research into mathematics education. As this article shows, *ESM* has not only grown in size, in step with the growth of the discipline it serves, but has also realigned its content to reflect the new ideas, new concerns and new technical developments that have come to the fore. It continues to be a rich source of innovative ideas in mathematics education and a vehicle for the dissemination of high quality research among both teachers and researchers. *ESM* has indeed become vital to the international mathematics education community, as Hans Freudenthal had wished it to be.

Appendix

Three former editors of *ESM*, Alan Bishop, Willi Dörfler and Kenneth Ruthven, kindly responded to the six questions reproduced below, which were sent to them via email in the summer of 2001. References to their responses are made in the Notes section as follows: "A. Bishop, Question 4" refers to the response given by Alan Bishop to question 4.

1. During your term as editor of ESM, what advances took place in understanding mathematics education and in what ways were these advances registered in *ESM*?
2. During your term as editor, what were the major theoretical and philosophical influences within scholarship in mathematics education and in what ways were these influences registered in *ESM*?

3. During your term as editor, describe any developments outside scholarship in mathematics education (e.g., a political development regarding an issue in education) which influenced this scholarship as reflected in the content of *ESM*.
4. During your term as editor, what policies were you guided by?
5. During your term as editor, what main function or functions did *ESM* provide? For example, was the main function that of communicating research among colleagues?
6. What were the reasons for the founding of *ESM*? What organization(s) were responsible for its founding? What decisions led to its founding?

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NOTES

1. A.G. Howson, email communication (01/08/2002).
2. "Propositions on the Teaching of Mathematics (Lausanne)" (1968). *ESM* 1, p. 244.
3. Ibid.
4. Ibid.
5. The national composition of the first ESM editorial board was as follows: Belgium – 1, England – 3, France – 3, Ghana – 1, Germany – 2, Holland – (editor), Italy – 1, Poland – 1, USA – 4, USSR – 1.
6. A.G. Howson, email communication (29/07/2002).
7. A. Bishop, response to *Question 4* (see *Appendix*).
8. Ibid.
9. Ibid.
10. France – 2, Germany – 1, Holland – 1 (& advisory editor), Hungary – 1, India – 1, Israel – 1, Japan – 1, Poland – 1, Sweden – 1, UK – 2 (& editor), USA – 1.
11. A. Bishop, response to *Question 2* (see *Appendix*).
12. A. Bishop, response to *Question 4* (see *Appendix*).
13. "Publisher's Announcement" *ESM* 19(2), 1988, p. i.
14. The national composition of the editorial board on the first issue edited by W. Dörfler was as follows: Austria – (chief editor), Australia – 2, Barbados – 1, Brazil – 1, Canada – (editor), France – 2, Germany – (1 and review editor), Denmark – 1, Holland – (editor), Hungary – 1, Israel – 2, Italy – 1, Japan – 1, Mozambique – 1, Poland – 1, UK – (2 and advisory editor), USA – 3.
15. K. Ruthven, response to *Question 6* (see *Appendix*).

16. The national composition of the board on the first issue that Ruthven edited was as follows: Australia – 1, Austria – (advisory editor), Brazil – 1, Canada – (1 & editor), Columbia – 1, France – 2, Germany – 3 , Greece – 1, Holland – (1 & editor), Israel – 3, Italy – 1, Latvia – 1, New Zealand – 1, Poland – 1, Portugal - 1, Russia – 1, Spain – 1, UK – 1 (& advisory editor and review editor), USA – 3.
17. http://www.ed.gov/databases/ERIC_Digests/index/

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