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COMPUTERS IN EDUCATION

Proceedings of the IFIP TC 3 Fifth World Conference on
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Sydney, Australia, July 9–13, 1990

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FOREWORD

The challenge of editing the Proceedings of an international conference of the dimensions of WCCE 90 is both daunting and exhilarating. In terms of the opportunity to interact with the world-wide community of computer using educators, the role was one to be grasped with enthusiasm. When examined more closely in the light of the sheer number and diversity of papers, and of the standard of editing and production achieved in the past, the task was formidable.

The Proceedings of this conference, as indeed the conference itself, stems from a fine academic and professional tradition. It has been the task of the current organisers, including the Proceedings' editors, to maintain this tradition while modifying it appropriately to give some flavour of the particular time and place.

The papers in this Proceedings were selected by referees in many countries, from more than 550 submitted in response to the initial call for papers for the conference. We are grateful to the many paper referees who assisted us by adding editorial comments as they reviewed the draft papers.

We would like particularly to express our thanks to the authors, who have taken considerable time and trouble to comply with the instructions for the preparation of camera-ready copy of their papers for this publication.

We have appreciated the information and advice offered to us by former editors of World Conference Proceedings, and by Stephanie Smit and John Butterfield of Elsevier Science Publishers B.V. The assistance of Carolyn Sim and Bronwen Dimond with many of the tasks involved in the final preparation of the manuscript has also been invaluable.

Anne McDougall
Carolyn Dowling

PREFACE

IFIP World Conferences on Computers in Education, held only once every five years, provide an opportunity for computer educators around the world to share their ideas and their experiences, their achievements and their frustrations in this rapidly developing field. The fifth World Conference is being held in Sydney, Australia in July 1990 after five years of planning and organisation. We hope that the decision to hold the conference in the southern hemisphere will increase the opportunity for participation by computer educators in developing nations. This concern is reflected in many of the papers and presentations at the conference.

This book contains approximately 190 papers presented at the conference, including keynote and invited papers. Abstracts of more than 350 presentations appear in the *Abstracts Proceedings* published by the Australian Council for Computers in Education. These combined volumes are a permanent record of what happened at WCCE 90.

Papers for the book were selected from the total number of presentations in order to offer a broad cross-section of countries, authors, and themes. All accepted presentations were sent to three independent reviewers: one from the same country as the paper's author, and one from another country, as well as the chairman of the paper's specific stream or mini-conference. The efforts of the hundreds of reviewers, too numerous to be named here, are a vital component of an IFIP world conference. They ensure fair and unbiased treatment of the proposals that we receive. Their contribution is greatly appreciated.

We received over six hundred proposals for papers, presentations, panels, workshops, and meetings, from forty-one countries. In addition, more than fifty proposals arrived during the months following the closing date in October 1989 and were too late to be reviewed for inclusion in the programme. I would like to thank the people, over two hundred of them, who took the trouble to prepare submissions to WCCE 90 but who could not be accepted for presentation. Their efforts, although unrecognised, are nevertheless an important part of the success of a refereed conference. I'm sure they will not be deterred from attending the conference nor from submitting again to the sixth WCCE in 1995.

The overwhelming response to the call for papers indicates the continuing growth and maturing of the computer education community. In order to highlight the diversity and richness of computer education, I structured the fifth World Conference as an 'umbrella' conference. Each sector of computer education has been allocated its own stream or mini-conference under the guidance of its own chairman.

The streams include elementary, secondary, university, vocational education and training, research, and rainbow. 'Rainbow' is a term we coined to describe presentations that cut across these streams, for example presentations on national computer education policies. This stream is like a rainbow because it encompasses all the 'colours' of the computer education spectrum. The mini-conferences include CBT 90, PEG 90, and Teleteaching 90 which respectively address the use of computer based training in industry, new tools in the classroom, and computing in distance education.

In addition, mini-conferences are being held before and after WCCE 90 in Auckland, New Zealand; Cairns, Australia; and Tokyo, Japan. All these mini-conferences are producing separate proceedings

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or publications, however, some key papers from the New Zealand conference are included in this book. Those papers presented jointly in Sydney and Auckland appear in their Sydney streams.

I am grateful to the stream and mini-conference chairmen, listed elsewhere, who have worked with me to develop the WCCE 90 programme. All have worked towards the goal of producing an internationally representative programme. WCCE 90 is not just a conference open to attendance by delegates from around the world – it has been organised by a *world* committee. International Programme Committee meetings were held at least once a year, sometimes twice, in different parts of the world over the last five years. Twenty to thirty countries were officially represented at these meetings and the costs were borne by each country, many times from the representatives' own pockets. Countries' representatives who were not present at the meetings still had a major role to play in disseminating information within their countries.

It has been hard work for all of us, and all of us have been volunteer organisers over and above our day-to-day paid jobs. Education is one of the few industries that runs non-commerical low budget conferences. WCCE 90 would not have been financially viable without the considerable time and energy provided voluntarily by the members of the international and Australian committees. About eighty people were directly involved in the committees, and these people drew on the resources of their employers and other colleagues to get the job done.

The conference would also not have been financially viable without the monetary support of our sponsors, especially the major sponsors: Microsoft, Commodore, Apple, and IBM. Their contributions, along with that of the Australian Computer Society, the host organisation for the conference, covered the high costs of printing and international communication in the years leading up to the conference. We thank all the sponsors for their support of computer education.

For me it has been an interesting challenge to create and build a large multinational event. However, it has also been an opportunity to forge friendships with colleagues in other countries, to discuss our common problems, and to learn from our differences. I hope readers use the international network that we have built, and that is represented in this book, to add to their experience and knowledge of computer education. I look forward to the next five years of our industry's growth and development.

Sandra Wills
WCCE 90 International Programme Chairman
Melbourne, February, 1990

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