THE GENDER AND SCIENCE AND TECHNOLOGY (GASAT) ASSOCIATION

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Abstract. *The Gender And Science And Technology (GASAT) Association is an international organization of people concerned with issues arising from interactions between gender and science and technology. The first GASAT conference was held at the Eindhoven University of Technology in Eindhoven, The Netherlands, November 9-13, 1981, some nine years before the birth of WEPAN. The conference was held due to "the growing number of persons concerned about promoting education in science and technology for young girls and women in various countries." Organized by a man from the Netherlands and a woman from England, twenty-five persons gathered in the Netherlands from around the world, including Germany, Norway, Portugal, Canada, and the United States, each contributing to a paper for a Proceedings. Many hours were spent in plenary and work sessions, comparing notes about the encouragement of women to pursue science and technology (engineering). Conferences are held every two or three years and have been central in establishing strong and influential networks of individuals and organizations that are engaged in research and grassroots activities that promote gender equity in science and technology. A board of seven regional representatives from around the world governs the organization. GASAT 8 in India, in 1996, the first conference to be held in a developing country, was attended by 230 participants from 42 countries, 31 of which are developing countries. GASAT 9, held in Ghana in July 1999, included 239 representatives from 36 countries. GASAT 10 will be held in Denmark in July 2001 with the theme of "World Wide Wisdom – socially responsible and gender inclusive Science and Technology." A general overview of the nine conferences to date will be given in this paper. The main themes run from those of the GASAT 2 Conference on Sex Stereotypes and Interactions, The Curriculum, Intervention Programs, and Teacher Education to those of GASAT 8 that focused on Education, Employment, Equality, and Empowerment.*

INTRODUCTION

The Gender And Science And Technology (GASAT) Association is an international organization of people concerned with issues arising from interactions between gender and science and technology which began with a concern by one man for the lack of women in science and technology. In 1979, several researchers in Northern Europe met informally to discuss their work concerning the access of girls and women to careers in scientific and technological fields [1]. As they shared information, it became obvious that the issue crossed national boundaries and cultural differences and that many initiatives were being taken to increase both access and retention [1]. Therefore, they proposed an international symposium so that all women and men working in projects about girls and science and technology (GASAT) could meet, share experiences, and learn from each other [1]. It should be understood that "technology" as used for this organization and paper includes engineering and technology.

In the early '80s, a professor in Science Education in the Netherlands, Jan Raat, became concerned that girls were "disadvantaged in science-and-technology education [2]." He noted that girls take less science (especially physics) than boys do and generally did not do as well as boys in the subjects. Dr. Raat felt that women should have the same career opportunities (many of which depend on knowledge of science and technology) as men after finishing their higher education and that it was a waste of talent that women did not participate in science and technology. He then became involved in a MENT-Project (ME=Meisjes=girls, N=natuurkunde=physics, T=techniek=technology) to create a situation where girls (12-15 years old) are encouraged to choose science (especially physics) and/or technology as readily as boys do. The project concentrated on 12-15 year olds, the lower part of secondary schools. Dr. Raat soon noticed that in mixed gender groups dealing with physics experiments, the boys in the group handled the equipment and did all of the "doing" while the girls timidly took notes. His project focused on 1) changing the content of physics curriculum to make it more appealing to young women, 2) making physics teachers more aware of the disadvantage girls were experiencing in their physics-lessons, 3) changing physics textbooks which seemed to be written for boys only and contained only pictures of boys and men involved in projects of primarily male interest such as cars, engines, and football, and 4) collaborating with others trying to solve the same problems.

Jan Raat happened to meet Jan Harding of the UK at a conference and began talking to her about his project. Dr. Harding was concerned for girls' science and technology education based on her experiences during many years as a

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science educator. She had noted that girls in single-sex schools chose physics and science classes in equal numbers with the boys. In a teacher training college she noted that many of the teachers in training felt they were not good enough to 'do' the physical sciences and felt alienated from them [3]. Dr. Harding was interested in the effect of types of science examinations and the type of school on the study of the sciences by young women. Having found a kindred spirit, and in alignment with the goal of collaboration of the MENT-Project, Dr. Raat secured funding from the Dutch Department of Education and began planning an international conference with Dr. Harding.

Thus, the first GASAT conference was held at the Eindhoven University of Technology in Eindhoven, The Netherlands, November 9-13, 1981, some nine years before the birth of WEPAN. The conference was held due to "the growing number of persons concerned about promoting education in science and technology for young girls and women in various countries [4]." The Dutch Department of Education supported the conference, including board and room, for twenty-five persons from around the world, including Germany, Norway, Canada, Portugal, Sweden, the UK, and the United States, each submitting a paper for the proceedings. The only cost to the participants was their transportation to and from the conference. This first conference was set in a charming retreat, complete with afternoon coffee, a very appropriate background for a diligent, working conference. Papers were published, but not presented at this first conference. Many hours were spent in plenary and work sessions, comparing notes about the encouragement of women to pursue science and engineering and technology. Volume 2 of the Conference Proceedings held the twenty-one submitted papers. The working sessions produced extensive reports that were published in Volume 3 of the Conference Proceedings on backgrounds of the problem, information about the structure of different educational systems and the place of science, and an outline for the future.

The first conference was a learning situation for all. The similarities and differences in the school systems were noted. The problems with the lack of participation of girls in physics and technology were worldwide. The word "technology" as used in most countries included "engineering." The conference name that first year was "Girls and Science and Technology." It was discovered that the term "girls" was more inclusive (K-12) in some countries than in others. However the conference name lasted until GASAT 5, when GASAT was changed to be an acronym for "Gender and Science and Technology."

The first international conference of GASAT was declared a success and plans were made for GASAT 2.

BUILDING AN INTERNATIONAL SOCIETY

Partly as a follow-up of the first GASAT conference, a participant, Svein Sjoberg, of GASAT 1 held GASAT 2 near Oslo, Norway two years later from September 5-10, 1983. An international committee and a national committee, including Svein Lie, ably assisted Svein Sjoberg. Financial support was obtained form several ministries of the Norwegian government as well as from Narst Hydro, Norwegian Telecommunications, and the University of Oslo, the host institution. The aim of the conference was to "consider research evidence on 1) differences in girls' and boys' attitude to, interest in, and achievements in school science and technology, 2) why so few girls get engaged in studies and careers in science and technology, and 3) experiences from intervention programmes aimed to stimulate more girls to do science [5]." Chairs were named for each of five sessions, 1) Sex stereotypes and interactions, 2) The curriculum, 3) Intervention programmes. What works and what does not? 4) Teacher education, and 5) Summing-up [5]. An international committee was responsible for the scientific part of the programme and consisted of the session chairs along with Svein Sjoberg, the coordinator. The national committee consisted of five persons involved in the "Jenter og fysikk" (Girls and Physics) project. They were assisted by the interdisciplinary secretariat for women's research at the Norwegian Research Council for Science and the Humanities. Fifty-seven participants engaged in lively conversations and debates on the issues. The Scandinavian countries were well represented at GASAT 2. Thirty-two papers were presented and published in the Conference Proceedings.

An international society had been established. Conferences would be held every two or three years. GASAT 3 was held in 1985 in London led by Dr. Jan Harding with Chelsea College as the host institution. Both international and national planning committees were formed. Over 100 participants attended, representing 20 countries, including Australia and New Zealand as well as four African and three Eastern European countries. GASAT 3 focused partially on the research that evaluated the intervention projects that had occurred since the original GASAT conference [1].

Immediately following GASAT 3, a group of participants began planning GASAT 4. They met informally in the foyers of theaters and in the wine bars of London, and concurred that GASAT 4 must have broader participation and must demonstrate the commitment of all to opportunity and to peace. Later, the Americans among that group formed the Planning Committee, which was responsible for all aspects of GASAT 4 held at the University of Michigan at Ann Arbor, Michigan. Jane Kahle and Jane Daniels served as the convenor and co-convenor for the conference. An International Committee and Dr. Jan Raat and Dr. Ilja Mottier of The Netherlands assisted this committee. GASAT 4 was 'A Celebration of Diversity: the diversity of people and cultures, the diversity of opportunities and challenges, and the diversity of science, technology, and engineering [1]. The 156 registrants in GASAT 4 represented 31 different countries. Asia and the Americas

were now included in the conference, as well as participants from the Peoples Republic of China, Thailand, and Jamaica for the first time. The papers written by the participants were organized under the following headings: research, evaluation, and intervention programs. One hundred and twenty-three papers were presented at the conference and published in three volumes.

By GASAT 4, an informal network concerned with common issues had developed to a "sophisticated international forum [1]." The presentations had become more experimental and less descriptive. Research and evaluation were important components of the conference. At this conference it was decided to change to the title of the organization to Gender and Science and Technology (but still GASAT) in recognition that the conferences were about the construct of gender and its intersection with science and technology in our world [7].

GROWING PAINS

GASAT 5 was a difficult conference. As Israela Ravina and Yael Rom, the GASAT 5 convenors, stated: "Israel, the Holy Land for so many of us is the crossroad of many cultures and civilization, ancient and new. Albeit political difficulties we managed to organize a well balanced program and attract participants from many countries to share knowledge and experience, aspirations and expectations on the participation of women in Science, Engineering and Technology [6]." Unfortunately, politics, for the first time in GASAT history, played a role in the lack of attendance and support from some countries to attend GASAT 5 in Haifa, Israel. Nonetheless, a full program hosted by the Technion, Israel Institute of Technology, was presented . As a part of the conference, the Technion conferred an Honorary Doctorate to Dr. Rosalyn S. Yalow, a 1977 Noble Prize Laureate for Physiology/Medicine. Some 100 papers were presented and published under the general themes of General, Pre-College, In College, and At Work. In addition, workshops and round tables were held.

GASAT 5 included a tour of Haifa and a reception hosted by the mayor of Haifa. This was the beginning of an educational component of GASAT: if the participants were to truly begin to understand a country, they must experience it. This became especially true later as the conference moved to third world countries. GASAT 5 introduced another facet to GASAT that would be continued: home groups. Each participant was assigned to a home group. Each home group consisted of some 10-20 participants, representing close to 10 countries, with a group leader. These groups met throughout the conference for discussions to give a smaller feel to the conference and to better learn about others from countries around the world.

GASAT was now grown-up and part of the growing pains was the need for a constitution and by-laws, a formal structuring of the organization. Long debate and long meetings were devoted to determining the initial formal structure during GASAT 5. A second large area of concern and debate, ever since GASAT 1, was the ability of authors to present their own papers at the conferences, rather than have them summarized by another party. The organization came to recognize that if authors were funded to attend international meetings, it was expected that they would present. In addition, it was no longer a requirement of GASAT that only those who presented a paper could attend the conference. A third area of concern was the limitation of the number of attendees allowed from the country hosting the conference. For GASAT 4, for example, the number of Americans allowed to attend was severely limited. At GASAT 5 and later conferences, this limitation has not been enforced.

GASAT MOVES ON

Over 130 authors from some 20 different countries were represented in the contributions to GASAT 6 held at the University of Melbourne in Victoria, Australia in July 1991. The papers addressed the following conference sub-themes: reviews, reflections and syntheses of GASAT work; current intervention projects: design, implementation and evaluation; current research findings: attitudes and practices; and future directions: challenges and possibilities. The conference included reports of the home groups, roundtables, symposia, and workshops. Some 210 participants from 20 countries attended. The goal of GASAT 6 was to bring closer together the things that are unnecessarily divisive: in particular, good pedagogy and the discipline of science and good workplace management and the structure of work. The participation of 16 representatives from developing countries was an exciting aspect of the conference. A well-attended special conference session was a discussion of issues common to women's progress in science and technology in developing countries. This issue became a high priority for discussion in the international Home Group sessions that followed [7]. Leonie Rennie, Lesley Parker, and Gaell Hildebrand led the Australian conference. An Australian Committee, a Melbourne Planning Committee, and an International Conference Reference Group assisted them.

GASAT 7 was held at the University of Waterloo in Waterloo, Ontario, Canada. Over 150 contributions from some 20 different countries spanning six continents addressed the topics of current innovative intervention projects, research findings, evaluative syntheses of interventions, and critical research papers. The program of GASAT 7 focused on four major themes: recruitment and retention of girls and women in science, engineering, and technology; developing a feminist perspective on science that recognizes the diversity of experiences of women, girls and indigenous peoples; creating a more inviting climate for work and study and developing strategies for change; and gender-sensitive science, engineering, and technology curricula. Ann Holmes, Conference Chair, Sharon

Haggerty, Program Chair, and Mary Beam, Local Arrangements Chair led the 216 participants. Local committees and an international GASAT Proposal Review Committee assisted them. A key GASAT concept, participation, was stressed during the conference that included panel discussions, home groups, and tours in the area. A wonderful culmination of GASAT 7 was the acceptance of a bid to hold GASAT 8 in a developing country for the first time: India [8].

"Achieving the four E's: Education, Employment, Equality, and Empowerment" was the theme of GASAT 8 sponsored by the Science And Technology for Women And Children (SATWAC) Foundation in Ahmedabad, India in January 1996. GASAT 8 was graciously and eloquently opened with an inauguration ceremony. The six-day conference, led by Jayshree Mehta, the Conference Chair, included cultural programs and excursions for the participants to experience the culture, the places, and the vibrant life of the city and country, in addition to usual sessions, roundtables, home groups, and pleneraries. Over 240 participants from more than 40 different countries enjoyed the warm hospitality extended to them. The conference featured new topics for GASAT such as agriculture, indigenous knowledge, and social change restructuring. The conference had progressed from GASAT 2, where all participants discussed each major topic, before moving on to the next area, to the four parallel sessions of GASAT 8. GASAT 8 followed the 4th United Nation's World Conference on Women in Beijing, China where issues relating to science, technology and development and women's participations were considered as major areas of concern. Delegates from the GASAT Association attended the conference in Beijing.

Since GASAT 8 had been such a success and wonderful education, the conference leaders were convinced that it would be to the good health of the organization if the next conference were also held in a developing country. After much discussion and planning, GASAT 9 was held in Accra, Ghana, in July 1999, the first time that a GASAT conference had been held in an African country. Georgina Quaisie of Accra led this huge undertaking. The conference was attended by 238 delegates from 36 countries. Drawing from their varied backgrounds, participants explored ways of sustaining the gains made at increasing access for girls and women to education and training and the challenges ahead in getting stakeholders to create more avenues for continuing education, particularly at the secondary level. They also advocated for equal opportunity to employment to enhance upward mobility of women. Participants were housed in a new, deluxe hotel and graciously hosted at a banquet by the Minister of Education, who has the increase of women in engineering and technology in Ghana as a major goal and gave strong personnel, material, and logistic support to the conference. Once again, the conference hosts provided a cultural education in the events sponsored by the conference. Funds from outside agencies provided sponsorship for many participants from developing countries. At the conclusion of the conference, the bid from Denmark was accepted for GASAT 10 to be hosted in Copenhagen, Denmark. To be held in July, 2001, the conference sub-themes are: 1) Changing Primary and Secondary School Education; 2) Transforming Higher Education within Science and Technology; 3) Creating a Gender-inclusive Labour Market within Science and Technology; 4) Merging Formal and Indigenous and Informal Science and Technology; and 5) Visions for Science and Technology in the New Millennium. The overall theme is World Wide Wisdom – socially responsible and gender inclusive Science and Technology.

MOVING FORWARD WITH GASAT

Table 1 below illustrates the rapid increase in participation in GASAT in the 20 years since the first International Conference was held in The Netherlands in 1981. The table shows the number of participants in each conference, the number of participants from developing countries at each conference, the total number of countries represented at each conference, the number of developing countries represented, and the percent of participation from the host country. Since GASAT 5, approximately 40 to 50% of the participation has been from the host country. The host country Ghana had 125 participants. Nearby Nigeria sent 38 delegates.

At the same time, the number of GASAT participants from developing countries has increased exponentially, especially during the last two conferences held in India and Africa. In Figure 1 below, the dark bar represents the total number of participants in each GASAT from GASAT 1 to GASAT 9. The light bar alongside in each case represents the number of participants from developing countries. Such participation commenced with GASAT 3 and has been growing ever since. This clearly indicates GASAT's growing influence and relevance, worldwide. In fact, GASAT 8 had a majority of the participants from developing countries and GASAT 9 had only 19 people who were not from developing countries.

GASAT 1 started with only 8 countries participating, whereas in GASAT 8, a total of 43 countries participated. The growing commitment in each country to the vital issues raised at these international forums and the work already being done indicate that GATAT can now become a dynamic movement. As a matter of fact, constant efforts have been made to enhance the participation of developing countries where the need is greatest. It was such efforts that have led to the holding of GASAT 8 in a developing country for the first time.

To make GASAT a dynamic movement, it is important that participation is promoted not merely among people from

TABLE I
GASAT PARTICIPANTS BY PARTICIPANTS AND DEVELOPING COUNTRIES

Year	Country	Total No. of Participants	No. of Participants from developing countries	Total No. of Countries Participated	No. of Developing Countries Participation	% of Participation from the Host Country
1981	GASAT 1 The Netherlands	25	-	8	-	25%
1983	GASAT 2 Norway	57	-	8	-	32%
1985	GASAT 3 UK	102	9	21	5	24%
1987	GASAT 4 USA	156	19	31	12	25%
1989	GASAT 5 Israel	104	7	18	7	39%
1991	GASAT 6 Australia	173	11	19	7	46%
1993	GASAT 7 Canada	232	34	25	15	47%
1996	GASAT 8 India	233	153	43	31	40%
1999	GASAT 9 Ghana	246	227	36	17	51%
2001	GASAT 10 Denmark		UPCOMING			

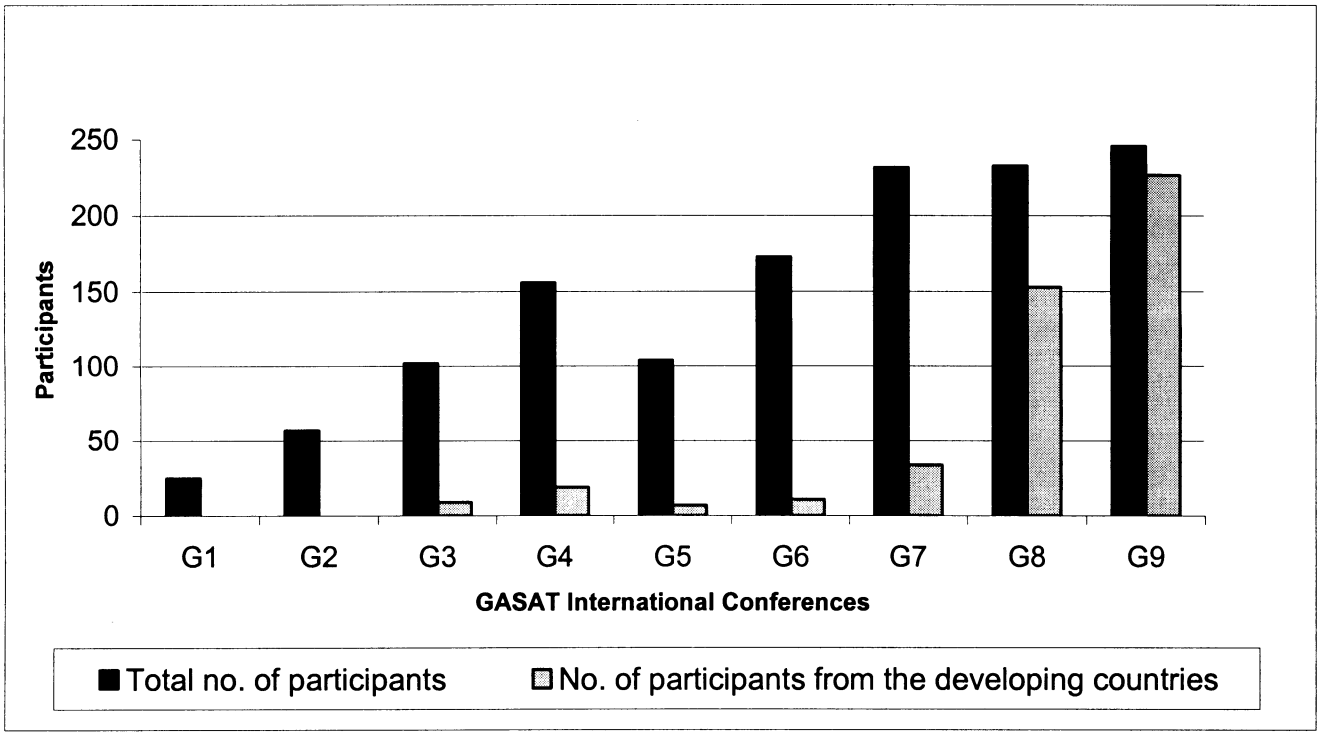

FIGURE. 1
GASAT PARTICIPATION BY DEVELOPING COUNTRIES

developing countries, but also amongst the youth of all countries, preferably those below the age of 30, who should be increasingly involved. How can this be achieved? In GASAT 8, for the first time support was given to young participant to attend GASAT.

A challenge for the host country of the last several GASATs has been to accommodate conference attendees who arrive at the conference with no financial support.

For more information on GASAT, visit their international website at www.gac.edu/~simpson/gasat/homepage.htm
National websites can be found at www.gasat.org.uk for the UK and www.ida.dk/politikfelter/Kvindepolitik/IDA-udvalg/Kvinde/Gasat10/default.htm for Denmark.

REGIONAL CONFERENCES

Immediately after the GASAT 5, the European and the Third World GASAT conference was held in Sweden (1992). After GASAT 8 in India, two large regional conferences were held in developing countries. GASAT Asia was held in Thailand and GASAT Africa was held in Malawi in 1998. Both of these conferences focused on gender issues related to education, science, and technology in their own regions. GASAT Africa was held again in Nigeria in the year 2000. Similarly GASAT (Europe) recently met during an Association for Science Educators (ASE) conference in the UK.

These regional conferences provided a vital forum for the researchers and educationalists in their region to follow up the Beijing commitments. GASAT participated in the Beijing conference as a member of Once & Future Action Network (OFAN) to set up a science and technology pavilion and organized seminars. GASAT international and regional conferences have received support from various organizations and agencies. the Norwegian Agency for Development Corporation (NORAD) and Rockefeller Foundation supported the GASAT held in the developing countries. GASAT has also received support from the United Nations Educational, Scientific and Cultural Organization (UNESCO); the Canadian International Development Agency (CIDA); the Swedish International Development Agency (SIDA); the Danish Development Assistance (DANIDA); the Department for Research Corporation (SAREC); The Netherlands Embassy; The Commonwealth Secretariat, UK; and local organizations.

CONCLUSION

By GASAT 7, the objectives of the organization had been solidified. The GASAT Association was concerned with issues arising from interactions between gender and science and technology [7]. Its objectives are:

- to encourage research into all aspects of gender differentiation in science and technology education and employment;
- to foster gender equity in science and technology, in education and in the workplace;
- to facilitate the entry of women into employment in the fields of science and technology, and their progress within such employment;
- to foster socially responsible and gender-inclusive science and technology;
- to provide a forum for dissemination and discussion of research findings and experiences of those working in the field;
- to provide a support network for those working towards the objectives outlines above.

GASAT is making its mark in the world. Largely unheralded in this paper on GASAT have been all of the long hours of volunteer work that have been done each year by the local planning committees, the international committees, the GASAT Board of seven regional representatives and its officers, as well as the support of their offices. The work has often been difficult. There have been differences of opinions and short-term objectives. However, through it all, GASAT has survived.

An assessment of successful strategies for attracting girls into science, engineering, and technology was compiled in a publication "Breaking the Mould" which contains reviews and analyses of research papers from GASAT 1 Conference Proceedings through GASAT 7. This was written by Mel Vlaeminke, Frankie McKeon, and Chris Comber of the School of Education, University of Leicester, with assistance from Jan Harding, and supported by the Office of Science and Technology, Department Trade and Industry, UK. This publication is useful to many researchers and practitioners as it covers successful initiatives from 100 projects from the proceedings of GASAT 1 to 7. Out of 123 references used, only four are from the developing countries, due to the low participation of researchers from developing countries during GASAT 1 to 7.

GASAT is serving as a world forum for women in science and technology. Its participants have been educated at an international level, have experienced science and technology in different cultures, have exchanged research methods and discoveries, have learned new thinking and approaches to science and technology, and together have encouraged women from around the world to pursue their careers in science and technology. Above all, perhaps, have been the wonderful friendships that have been developed in the process.

REFERENCES

[1] Daniels, Jane Z., Kahle, Jane B., Editors, Proceedings, Fourth GASAT Conference 1987, University of Michigan, Ann Arbor, Michigan, 1987.
[2] Raat, Jan H., "Intervention Strategies in Favour of Girls' Achievement in Science (Physics) and Technology in the MENT-Project," Contributions GASAT Conference 1981, Eindhoven University of Technology, Eindhoven, The Netherlands, 1981, Volume 2, pp. 183-190.
[3] Harding, Jan," Report of Science Examinations and the Type of Schools," Contributions GASAT Conference 1981, Eindhoven University of Technology, Eindhoven, The Netherlands, 1981, Volume 2, pp. 105-122.
[4] Preface, Contributions GASAT Conference 1981, Eindhoven University

of Technology, Eindhoven, The Netherlands, 1981, Volume 2.
[5] Preface, Contributions to the second GASAT conference, Institute of Physics, University of Oslo, Oslo, Norway, 1983.
[6] Ravina, Isrela, Rom, Yael, Editors, Contributions to the Fifth International Conference 1989, Technion-Israel Institute of Technology, Haifa, Israel, 1989, iii.
[7 Rennie, Leonie J., Parker, Lesley H., Hildebrand, Gaell, M., Editors, Proceedings of the Sixth International GASAT Conference, The University of Melbourne, Victoria, Australia, 1991, Volume Three.
[8] Haggerty, Sharon, Holmes, Ann, Editors, Contributions to the Seventh International Gender and Science and Technology Conference, The University of Waterloo, Waterloo, Ontario, Canada, July, 1993.

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