# SOCIAL JUSTICE AND THE MATHEMATICS CURRICULUM: AN EVALUATION OF ONE ATTEMPT TO DEVELOP AN INCLUSIVE CURRICULUM

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*The Junior Secondary Mathematics Resource Schools Project was established with a central purpose: "To enhance and improve the mathematical capability of all students." Its realisation was dependent on the collective expertise and enthusiasm of the project co-ordinators on the six Project schools, their associated "key-teachers" and other staff, and the co-ordination and support available to the Project as a whole. The research design for the evaluation of the J.S.M.R.S.P. acknowledged the existence of distinct communities of interest with respect to the Project. This paper reports those aspects of the study most likely to be of interest to the research community: that is, the study design and the student and teacher outcomes that can be associated with the implementation of this innovative curriculum and the associated teacher professional development. At this stage it appears that Project teachers are reporting a growing satisfaction with their participation in the Project and a growing awareness, understanding, and endorsement of the Project's goals. Student outcomes suggest that the emerging inclusive curriculum is succeeding in both cognitive and affective areas at least as well as other more conventional curricular practices.*

The Junior Secondary Mathematics Resource Schools Project (J.S.M.R.S.P) is a three year project (1991-3) set within Years 8-10 of schooling. It is run and fully funded by the Education Department of South Australia and, since the beginning of 1992, has been incorporated as part of the Focus School Program. Focus Schools are expected to develop exemplary teaching and learning pedagogy in their focus area and to document this in ways that other schools can use. This involves preparation of print resources and a commitment to collaborate with other schools through leadership of local networks.

The project's aim of improving students' experiences and outcomes was to be achieved through attention to the learning needs of all students and, in particular:

- the development of mathematical knowledge and skills appropriate for the 1990's;
- the promotion of a positive attitude toward mathematics;
- an appreciation of the wide application and contribution of mathematics to the lives of all people.

The J.S.M.R.S.P. was established through the allocation of resources to six schools. These resources took the form of a cash allocation to support buying materials, teacher release and travel, and the funding of a project coordinator in each of the schools. In order to establish a project "team" in each of the schools further personnel funding enabled two or three teachers in each school to be appointed as Key Teachers and given a small amount of release time for project duties.

\Two sets of forces operated in the process of selecting the project schools. These were the need to:

1. have one in each of the then Education Areas into which the state was divided (four in metropolitan Adelaide and two country Areas)
2. choose schools such that each could take a special focus on a different aspect of educational disadvantage and/or targeted group.

This second criterion was linked to the school's setting or client group. Special focus areas were Aboriginal students, students in poverty, isolated students, girls, students from non-English speaking backgrounds and students with special learning needs and this provided a subtext for the general developmental work being done in the school.

It is worthy of note that a proven track record or particular emphasis on mathematics as part of the school's background and practice were not used as criteria.

**Operations of the project**

The J.S.M.R.S.P. operates in three concurrent phases:

Phase 1- in the six J.S.M.R.S.P. schools

Phase 2 - in selected networks of state secondary schools which form the outreach program of the S.M.R.S.P.

Phase 3 - in the Focus School Program.

*Phase 1 - the developmental phase*

Phase 1 consisted of the developmental work done in each of the J.S.M.R.S.P. schools. Project schools identified different needs, priorities and issues and this gave the Project its originality and diversity. At the same time a strong sense of collaboration helped establish a common operational framework. Coordinators met for sharing and planning for two days each term. Less frequent meetings of project school principals and of key teachers from all of the schools were important factors in building a strong cooperative base.

The major focus of this phase was the development and documentation of inclusive and exemplary junior secondary mathematics programs which reflected and incorporated current political, pedagogical and resource aspects. An extensive and detailed Project Evaluation was undertaken, and it is the data from the evaluation of this phase of the project which provides the basis for this paper.

*Phase 2 - the outreach phsse*

J.S.M.R.S.P. schools have a commitment and responsibility to share programs, practices and resources. Schools which were able to meet criteria necessary to become a member of the J.S.M.R.S.P. outreach program had to formally apply and be selected on the merit of their application. In 1992 twenty-two schools were accepted, while in 1993 this number had grown to thirty-three.

*Phase 3 - the dissemination phase*

The general Focus School Program work of the J.S.M.R.S.P. takes two forms - preparation of publications based on the Project and a broader professional development program for schools and teachers outside of the outreach program. Publications address issues such as using the *National Statement* (AEC, 1991) in curriculum construction, assessment, managing resources and exemplary lessons. As the Project moves into its final stages more documentation, much of it resulting from evaluation activities, will become available.

**STUDY DESIGN**

The evaluation was structured around three purposes. These three purposes required distinctively different data collection procedures.

Purpose 1. *Informing progressive action*

It was essential for the efficient implementation of the Project that information be collected which would inform Project Co-ordinators in the short-term of the local realisation of the Project's goals. Such data was also intended to provide on-going documentation of the developmental processes associated with the Project. The choice of data collection techniques for Purpose 1 reflected the principle that the most efficient progress towards teacher change would occur where the information likely to inform teaching practice was collected by the individuals required to act on that information.

Purpose 2. *Focussed goals and site-specific outcomes*

Some of the goals of the project were best documented in the form of site-specific case studies. The amalgamation of these case studies under themes which reflected the concerns of the project: inclusive curricula or community involvement, for instance, have the potential to inform the practices of other schools which share a particular concern. The purpose of an evaluation with respect to these goals was realised through site-specific case studies, collated in monographs combining related themes.

Purpose 3. *Accountability and the achievement of general Project goals.*
The overall goals of the Project over all sites could be summarised as "the development of school mathematics programs which will improve the mathematical capability of all students, together with professional development to facilitate the implementation of these programs in Project Schools and elsewhere". As such, the success of the Project could be judged by the extent to which these general goals were achieved.

Any educational project finds itself enmeshed in a web of multiple accountability: to a central administration, which may also be the funding body; to regional administrations with their own priorities and concerns; and to participant schools, students, teachers and communities. All these groups will have their own notions of the purpose of the Project, their own feelings of ownership, and their own demands. These multiple accountabilities can be aligned with three levels of responsibility: the Education Department, the Region, and the School Community. This project, in particular, was conceived in a manner which invoked regional and local concerns and encouraged feelings of project ownership at all levels. To be of value the evaluation needed to provide information in a manner that would inform action at each level.

## DATA COLLECTION

### Purpose 1 - Formative evaluation to inform local implementation

Working from a draft of a Vision Statement of the Project's goals, Project coordinators and key teachers translated general statements such as "Students will be confident in using and applying mathematics in a range of contexts" into a more detailed listing of "Intended outcomes for students". This listing identified several "indicators" associated with each of the outcomes from the vision statement, and linked these to "implications" for teaching. This document provided the structure for Purpose 1 data collection. While the document derived from the original outcomes in the Project Vision Statement, each site elaborated the document in ways that reflected the local concerns of the site, and the professional readiness and capacity of the participant staff to give practical meaning to the Project's goals.

Three strategies were suggested by which teachers might monitor their implementation of the School Indicators/Implications document. The strategies proposed were selected as combining maximum information with minimal additional teacher workload. The strategies were: *annotated classlists*; the *IMPACT* student self-assessment procedure; and, *student work portfolios* (Clarke, 1989). As the Project evolved, other data collection methods were employed. In particular, student journals were used on several sites. Sites tended to use methods that could be integrated easily into instruction and which also served local assessment purposes. In addition, Site Co-ordinators initially maintained a *work-log* in which they recorded an outline of each day's activities. These work-logs provided a record of the implementation of the Project, and were intended to inform the subsequent implementation of the Project on other school sites, by providing details of the role of the School Co-ordinator.

Documents relating to Purpose 1 are Project Implementation Documents and did not form part of the data base for this paper. The best accounts of Purpose 1 implementation will be available in the case studies to be titled: *The Process of Change*. These case studies will provide the clearest documentation of the process by which the Project was realized on each site.

### Purpose 2 - Issues-based data collection

The realisation of some Project goals were most usefully documented in ways that reflect site characteristics and concerns. For instance, the development on each site of mathematics programs which acknowledge and accommodate the needs of specific disadvantaged groups was best documented in site-specific terms. Project outcomes of this type took the form of collections of site-specific case studies, intended to offer teachers in other schools suggestions concerning the most effective ways in which particular issues or groups might be accommodated within a school mathematics curriculum.

### Purpose 3 - Overall Project Evaluation

*Student data collection*

Project goals were characterised by certain key terms or phrases. One such term was "inclusive". The Project Evaluation collected data on the participation rate of identifiable student groups: Girls; NESB students; Aboriginal students; Economically-disadvantaged students; and, Special Education students. This data took the form of enrolment in specific mathematics classes and class attendance.

**Student confidence** was another key term. A survey instrument was developed for the measurement of student attitudes and, in particular, student confidence with respect to mathematics.

**Student perceptions of the classroom environment** were monitored twice yearly in all participant classrooms on all sites. Items from the *Learning Environment Inventory* (Anderson, Walberg & Fraser, 1982) were adapted to form a suitable instrument, administered in terms 2 and 4 each year.

For the purposes of the Project Evaluation, **student cognitive outcomes** of the Project were measured using an instrument of open-ended tasks (the Common Assessment Tasks - CAT 1 and CAT 2, see Sullivan and Clarke, 1991; Clarke, 1993). This instrument was supplemented by an adaptation of the ACER PAT test, revised by the Project Team to improve local validity, and intended to measure conventional learning outcomes.

*Teacher data collection*

A **Skills Audit instrument** was developed on which teachers were asked to indicate their level of professional development with respect to specific teaching practices: their level of skill in the specific practices; their willingness to employ them; their experience in their use; their confidence in their use; and any related comments. This instrument was administered to participating Project teachers each year, commencing in term 4 of 1991. One goal was to detect the influence of length of participation in the Project on teacher skill acquisition.

In addition, changing **teacher beliefs about effective mathematics teaching** and their educational priorities were monitored through interviews. Interviews were conducted by the Project co-ordinator each year. A suitable interview protocol, employing a card-sorting technique, was devised for this project.

An annual teacher questionnaire, to be administered in term 4 of each year, measured **participant teacher satisfaction and concerns** with the Project.

## RESULTS

This paper draws upon Purpose 3 data collection over the first two years of the project.

### Teachers

From analysis of the data, it appeared that Project teachers were particularly sensitive to the role of discussion and communication in their classrooms. Current practice was sometimes seen as different from the practice associated with effective teaching. These differences took two forms. Current practice was seen to give less value than that associated with effective teaching in the areas of: students value other students' ideas; closed tasks; computers; teacher poses challenging questions; students ask questions and initiate discussions; students clarify and justify ideas; students use a variety of tools to solve problems and to communicate. Alternatively, current practice was seen as overvaluing particular approaches, as in the case of: individual work; conventional mathematical terms; teacher explains and demonstrates; students work on textbook problems.

Analysis of teacher responses to the Skills Audit instrument distinguished skill in a particular teaching strategy from experience and confidence in its use, and willingness to employ it in the classroom. The high mean level of willingness on every item suggested a teacher sample committed to classroom experimentation, with a willingness to innovate. Areas in which teachers reported low levels of skill and confidence included the negotiation of the curriculum with students, alternative assessment strategies, and accessing community resources.

Participating teacher concerns with the J.S.M.R.S.P. project in 1991 centred on a perceived lack of definition of their role and on what was seen as an excessive workload associated with involvement in the project. The 1992 Interim Evaluation Report highlighted this concern. Teacher satisfaction data collected in late 1992 when compared with 1991 data showed either stability or improvement on every measure of teacher satisfaction with the project. A significantly greater proportion of teachers reported that they had "learned a lot from Project training and development sessions" in 1992 than was the case in 1991. A significantly improved understanding by teachers of the project's goals was also evident from a comparison of 1991 and 1992 data. Role definition and workload, while still of concern, were not as significant as in 1991.

**Students**

Students within the study were characterized with respect to five dichotomous variables: Participation in project classrooms; School card possession (a measure of socio-economic disadvantage); Aboriginality; Non-English Speaking Background; Gender. The following statistically significant differences were evident in both 1991 and 1992 data analyses:

1. Project students reported significantly higher levels of satisfaction with their mathematics classrooms than did non-project students.
2. Project students were significantly less likely to perceive their classroom environment as difficult than were non-project students.

With respect to cognitive outcomes:

1. Project students performed at least as well as non-Project students at the same year level on a test of conventional mathematical knowledge.
2. Project students performed at least as well as non-Project students on five short open-ended mathematics tasks.
3. Project students were significantly more successful on an extended problem solving task than were non-Project students at the same year level.

It appears that students are in no way disadvantaged by their participation in Project classes and that significant positive outcomes of project participation can be identified in both cognitive and affective domains.

## CONCLUDING DISCUSSION

The Junior Secondary Mathematics Resource Schools Project was established with a central purpose: "To enhance and improve the mathematical capability of all students." This was an ambitious goal. Its realisation was dependent on the collective expertise and enthusiasm of the project co-ordinators on the six Project schools, their associated "key-teachers" and other staff, and the co-ordination and support available to the Project as a whole. A distinctive aspect of the Project was the extent to which the interpretation of the Project's goals was *intended* to be site-specific. While all schools shared the common central purpose, each school offered a particular perspective on the teaching and learning of junior secondary mathematics. This perspective reflected the social, cultural and academic characteristics, and the interests, strengths and priorities of each school. The notion of an "inclusive curriculum" which pervaded Project documents took on very distinctive meanings at each school.

A more specific detailing of the Project's goals placed emphasis on "equity and social justice", teacher professional development in the areas of "teaching and learning processes" and "resource management", "parent and community participation", and "fully documented, well trialled junior secondary mathematics programs". These goals provided the structure for the Project and the broad parameters for the project evaluation.

The research design for the evaluation of the J.S.M.R.S.P. acknowledged the existence of distinct communities of interest with respect to the Project. This paper reports those aspects of the study most likely to be of interest to the research community: that is, the study design and the student and teacher outcomes that can be associated with the implementation of this innovative curriculum and the associated teacher professional development.

At this stage it appears that Project teachers are reporting a growing satisfaction with their participation in the Project and a growing awareness, understanding, and endorsement of the Project's goals. Student outcomes suggest that the emerging inclusive curriculum is succeeding in both cognitive and affective areas at least as well as other more conventional curricular practices. Evaluation of the Project's impact on increasing the successful participation in school mathematics of educationally disadvantaged groups will be undertaken once data collection is complete. It is possible, at this stage, to justify some degree of optimism, since increased student success and satisfaction seem to be emerging characteristics of mathematics classrooms within the J.S.M.R.S.P.

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