

**MACQUARIE
UNIVERSITY**



**FACULTY OF
HUMAN SCIENCES**

**The Centre for Research in Mathematics and Science
Education**

(CRiMSE)

Department of Education

Macquarie University

Five-Year Review

2004-2009

Report of the Review Panel

October 2009

1. Review

Structure of the review

The Executive Dean and Associate Dean Research selected an independent review panel. Membership included an external chair and two members from within Macquarie University.

Members of the review panel

| | |
|------------------------------------|--|
| Professor Kaye Stacey | (Chair) Foundation Professor of Mathematics Education, University of Melbourne. |
| Associate Professor Quentin Parker | Associate Professor in Astronomy, Department of Physics, Macquarie University |
| Professor Jennifer Bowes | Associate Dean Research Faculty of Human Sciences and Professorial Fellow at the Institute of Early Childhood, Macquarie University. |

Methodology

CRiMSE provided the panel a comprehensive portfolio of its recent activities, including major achievements, research performance, financial data, staffing information and a selection of publications from Centre members

The review process was held on September 14, 2009 where the panel undertook a series of interviews with Centre staff as well as major stakeholders of the CRiMSE from within the University and from one external body. A list of interviews is provided in Appendix A.

Objectives of the review

The purpose of this review was to assess and comment on the quality, productivity, directions and governance of CRiMSE. The review panel was requested to examine the nature, quality and impact of the CRiMSE research, HDR supervision and end-user engagement. Finally the panel was requested to identify future directions and possibilities for the Centre.

Terms of reference

- Review the extent to which CRiMSE has achieved the goals that were established at its inception in 2004.
- Review the plans presented by CRiMSE for the next 5 years in terms of its functions and goals; its Strategic Plan and Key Performance Indicators; the resources required to enable it to meet its goals; and its links with the research goals of the University; and its overall viability and potential to grow.

- Make recommendations for the future management of the Centre, including nomination of a Director, the membership of the Centre's Management/Advisory Committee and the structure of a new constitution.

In addition, the Executive Dean of Human Sciences provided the following guidelines to reviewers:

1. Explore how the host Department sees CRiMSE in its future
2. Make recommendations on how the group can reach its potential
3. Has the Centre explored the potential research links both within and outside the University?
4. Examine the membership profile of the Centre
5. To what extent is CRiMSE a research centre or are its activities more focused on professional development?
6. Does the Centre have the capacity to develop into a University Research Centre?

Reporting

The review panel is requested to submit a formal review report to the Executive Dean.

2. CRiMSE Background

A mathematics education research group consisting of three full-time lecturers, Michael Mitchelmore, Joanne Mulligan and Lynne Outhred, was formed in the School of Education in 1992. When the senior member of this group, Michael Mitchelmore, retired from his full-time position in 2004, the Dean of the then Australian Centre for Educational Studies asked him to establish a research centre to extend the work of the group. Firstly, the centre was to bring together researchers from across the various elements of the Australian Centre for Educational Studies as well as from other divisions within the university. Secondly, it was to include science education—an area where there had been only one full-time lecturer and which had therefore not been able to develop a strong research profile.

Associate Professor Mitchelmore therefore drew up a proposal for a Centre for Research in Mathematics and Science Education (CRiMSE) that was initially to have a life of two years. The division subsequently endorsed this proposal, and Associate Professor Mitchelmore took up his position as Director of CRiMSE in September 2004.

The goals of CRiMSE, as set out in its original constitution were as follows:

- to develop a research program in the areas of mathematics and science education that will attract funding from internal and external bodies
- to promote collaboration between researchers in the area of mathematics and science education both within the Division and across the university
- to increase the number of students engaged in research on mathematics and science education
- to establish a reputation for excellence that will be recognised as such by stakeholders in Sydney and eventually in New South Wales
- to develop into a University Centre within five years of commencement of operations

3. Review Panel's Response to the Terms of Reference

Review the extent to which CRiMSE has achieved the goals that were established at its inception in 2004.

Most of the original goals have been achieved, although modestly (these are research goals, research training goals, community contribution, mentoring of new staff etc.). However little progress has been made on goals 2 and 5.

Based on the data provided by A/Prof Mitchelmore on pages 17 & 18 of the Director's report, CRiMSE appears to be covering the cost of the Director's salary, with the income earned through the Institutional Grants Scheme and Higher Degree Research candidate completions. No clear evidence was given to support the suggestion that this was not the case. (Please see Panel Recommendation #3)

The CRiMSE team is working well together on research into mathematics education, providing mutual support and significant mentoring for new staff and HDR candidates. These are a key part of their objectives and they have achieved these.

Review the plans presented by CRiMSE for the next five years in terms of its functions and goals; its Strategic Plan and Key Performance Indicators; the resources required to enable it to meet its goals; and its links with the research goals of the University; and its overall viability and potential to grow.

While the original Strategic Plan and Key Performance Indicators were appropriate for the Centre's development in its early years, continuation of the current modest plans will not be sufficient to facilitate the necessary growth required to establish a Macquarie University Research Centre. The Centre needs to develop and implement strategies that will significantly increase the scale of the operation.

The strategic plan submitted on pages 12 – 16 of the Director's report is very strong in terms of process and maintaining a very strong academic unit for research and research training. However it is missing a strategy for growth – especially future staffing increases – and there is no associated future budget plan. The Centre can only increase output significantly if it gets more staff, and how this might happen is not addressed in the documents.

Make recommendations for the future management of the Centre, including nomination of a Director, the membership of the Centre's Management/Advisory Committee and the structure of a new constitution.

A/Prof Joanne Mulligan is the only potential director with a full time appointment, however she expressed an unwillingness to take on the role at this time but might be prepared to do so in the future. *

Currently the Centre lists 14 members of its management/advisory committee. While this might be useful from a public relations point of view, it is more than is necessary to manage a centre with nine core members and small income. Having such a large advisory committee has not resulted in the Centre achieving a high profile.

As part of the bid to become a Faculty Research Centre in 2010, a new constitution must be developed, the advisory committee needs to be restructured and streamlined, and the Centre's terms of reference need updating.

The panel recommends that regardless of who is appointed as director, A/Professor Mitchelmore should be retained in an appointment that would utilize his expertise in mentoring younger scholars and HDR candidates, grant writing and project management.

* Following the formal review, the Director of the Centre provided clarification of this point, saying that A/Prof Mulligan expressed an unwillingness to take on the additional role at this time but might be prepared to take up a new appointment as director.

Further Observations of the Review Panel

1. Following its review of CRiMSE, the panel was unanimous in its recognition of the importance of mathematics and science education research. This was seen as an area of high national priority.
2. The panel recognized the central role played by CRiMSE in the research profile of the Department of Education at Macquarie University.
3. From the submitted papers and interviews held during the review, the panel was impressed by the significant role played by CRiMSE researchers in:
 - mentoring HDR candidates
 - organising a broad range of research colloquia
 - encouraging HDR candidates to present their research findings at international conferences.Particular mention was made of Associate Professor Michael Mitchelmore and the helpful advice and feedback he gives to all Centre members.
4. The panel found that in the five years since its inception the Centre has largely reached its original research goals, research training goals, publication goals, and has impacted productively on the Department's teaching programs. It has also contributed to the improvement of education in the outside community.
5. The panel regarded the research outputs to be of very good quality but relatively modest in number. The panel believed that one reason for this moderate level of research output was the relatively small number of researchers within CRiMSE, exacerbated by recent retirements. This points to the Centre's need to develop its research capacity.
6. While CRiMSE has attracted some research funding from the ARC and other sources, the panel stressed the need to secure a significant increase in its funding levels if it is to increase the overall research capacity of the centre. Without a significant increase in funding, the Centre is severely limited in the number of projects that it can manage, since its members seem to be working to capacity. A need was also seen to attract additional researchers from across the university to join the Centre. A good start has been made with Leigh Wood in the Department of Business.
7. Of major concern to the panel was the centre's relatively weak profile within the University. The representative from the NSW Department of Education and Training (DET) reported that CRiMSE was one of many research organisations that DET dealt with and in that context was seen as a relatively small player. In relation to this profile, the panel noted that the research links established by CRiMSE members had not extended far beyond the original University Division in which it was formed. Other University researchers from beyond this Division, even those engaged in related research areas were found to be unaware of CRiMSE's existence.

8. The Centre needs to have more successful engagement with research partners both within and external to the University, with an aim of attracting more research funding and producing more research publications. To enhance its research profile, all members of CRiMSE would have to communicate its research impact, achievements and capacity more effectively both to their peers and to the broader community.

The panel noted that of all the publications provided to the panel for its information, only one referenced CRiMSE in its author byline. This needs to be rectified in all future publications. Authors should note that they may reference both the Centre and their main department in a byline.

9. The panel noted the considerable imbalance in the levels of research activity in mathematics and science education research and that there was no strategy in place to increase the levels of research in science education. This was viewed as a major weakness of the Centre by the panel.
10. The panel considered that CRiMSE should not continue under its current strategic plan, as it shows little capacity for significant growth. To continue, the centre will need to develop a more ambitious plan for growth in research quality and excellence. Such growth will have to be supported by the Department of Education and the Faculty of Human Sciences.
11. The panel recognized that there was a significant level of confusion relating to how the Centre was incorporated into and contributed to the budget of the Department of Education and saw the need for greater transparency of funding arrangements.

4. The Review Panel's Response to the Directions of the Executive Dean

- *Explore how the host Department sees CRiMSE in its future.*
The Head of Department was not positive on this issue and expressed concern about the Department's capacity to continue funding the Centre in its current structure. The panel recognised CRiMSE as the only strongly cohesive research group in the Department and as such its significant value to the Department's research profile.
- *Make recommendations on how the group can reach its potential.*
 - To reach its full potential, the Department must appoint a full-time director. The panel recommends that the Department advertise internally and externally for a Professor/Associate Professor in science or mathematics education immediately.
 - The Centre must develop more ambitious income generation goals by including more extensive professional development and other services to schools or education department. It needs to diversify sources of research funding beyond ARC. The Centre's main budget plan for growth is to increase its capacity by increasing HDR numbers: the likelihood of this must be realistically assessed. Another source of income that needs to be explored in greater depth is that which could be derived from professional development.
 - The Department should retain A/Prof Mitchelmore in his grant writing, project management and HDR candidate mentoring roles so CRiMSE does not lose any research capacity.
- *Has the Centre explored the potential research links both within and outside the University?*
&
- *Examine the membership profile of the Centre*

The Panel believes that the Centre needs to place more emphasis on establishing research collaborations throughout the University and with the wider research community. The Panel therefore recommends that the Centre expand its proposed longer-term strategies (detailed in page 13 of the Director's report), to establish a research network among mathematics and science educators on a statewide and/or national level.

The membership of the Centre, its profile and outreach could possibly be much larger, but such expansion will only result in more research outputs if the Department invests in appropriate new staff.

- *To what extent is CRiMSE a research centre, or are its activities more focused on professional development?*

CRiMSE is primarily a research centre, and given the number of full-time researchers in the Centre, they have produced outcomes of very good quality but relatively modest in number. However, the main avenue for additional income generation will come from professional development. This could be greatly expanded as a source of income for research. If this strategy is adopted, it needs to be done so very carefully as it could lead to CRiMSE losing its research focus and becoming mainly a professional development centre.

- *Does the Centre have the capacity to develop into a University Research Centre?*

Not immediately and not without significantly more support from the Department and Faculty. First it must become a Faculty Research Centre and demonstrate success at that level. On page 13 of the Director's report, they discuss being ready to apply for national research centre status in five years, or a cooperative research centre. This seems extremely ambitious and the strategic plan on previous pages does not show how this can be done.

5. The Review Panel's Recommendations:

1. The panel recommends the appointment, as soon as possible, of a Director who holds a full-time academic position. Such an appointment should be at least at the Associate Professorial level in the area of mathematics or science education, and is essential in order to:

- establish a continuity of leadership on site;
- ensure that the Director of CRiMSE is embedded into the activities of the Department and the Faculty; and
- facilitate an ongoing development of research networks and collaborations within the University and in the external community.

2. The panel recommends the centre consider its role in science education research. The panel proposes two options,

- Option 1: That the Centre not continue with science education research as part of its research and research training portfolio, focusing instead solely on mathematics education or on mathematics and ICT education. To follow this option, the Department will need to include in its own strategic plan, details on how it will build its capacity in mathematics education.
- Option 2: That the centre retains science education research in its research and research training portfolio but with a considerable investment of resources to strengthen this aspect of research.

The resources needed to follow option 2 include:

- that the Department of Education appoint at least one other active science education researcher, specifically in the area of physics and/or chemistry education.
- that Dr Wilhelmina Van Rooy be considered for the position of Deputy Director.
- that the centre develop a clear strategy to engage other researchers in science education from within the University, and to liaise more strongly with scientists within the University with an active interest in science education. Such a strategy is an essential requirement if the centre is to seek Faculty or University Research Centre status in the future.

3. The panel recommends that the Department develop a far greater degree of transparency in their budgeting practices for the Centre for future years with agreed funding to the Centre based on the its HDR candidates and completions, publications and research grants. The Centre should also develop a stronger financial plan for its future.

4. The panel recommends the co-location of the offices of all CRiMSE members who are part of the Department.
5. The panel recommends that the Faculty provide appropriate support to CRiMSE to develop a more effective web presence and that the website be improved in content and design as a matter of urgency.
6. The panel recommends that CRiMSE have access to basic levels of administrative support within the existing pool on par with the support that is available to all the Department's academic staff and that administrative staff be made aware that the Centre's activities are as important as other activities of the Department of Education.
7. The panel recommends that if the Centre is to continue, it must commence preparations for a Faculty Research Centre bid to be submitted in 2010.
8. As part of the bid to become a Faculty Research Centre in 2010, a new constitution must be developed, the advisory committee needs to be restructured and streamlined, and the Centre's terms of reference need updating.

Schedule of Interviews for CRiMSE Review Panel

Date: Monday, 14 September 2009

Venue: Building X5B Room 012, Macquarie University

| Time | Interviewee/ Activity |
|-------------------|--|
| 9.15 – 9.30am | Welcome to panel members at CRiMSE |
| 9.30 – 10.00am | Professor Janet Greeley, Executive Dean Faculty of Human Sciences |
| 10.00 - 10.45am | A/Prof Mike Mitchelmore Director of CRiMSE |
| 10.45 – 11.15am | A/Prof Joanne Mulligan Deputy Director of CRiMSE |
| 11.15am – 11.45pm | Prof John Hedberg Head, Department of Education Faculty of Human Sciences |
| 11.45 – 12.15pm | Professor Bill Thompson Professor of Psychology Department of Psychology Faculty of Human Sciences |
| 12.15 – 12.45pm | Group of HDR candidates from the CRiMSE: <ul style="list-style-type: none"> • Kate Highfield • Kristy Goodwin • Salma Tahir |
| 12.45 – 1.45pm | Lunch |
| 1.45 – 2.15pm | Mr Peter Gould NSW Department of Education and Training |
| 2.15 -2.45pm | Dr Wilhelmina Van Rooy Departmental Research Coordinator Science Education Researcher |
| 2.45 – 3.15pm | Prof Mike Mitchelmore Director of the CRiMSE A/Prof Joanne Mulligan Deputy Director of CRiMSE |
| 3.15 – 3.45pm | Professor Janet Greeley, Executive Dean Faculty of Human Sciences |