Curriculum Framework Implementation: Measuring the Impact on Secondary Mathematics Classroom Culture

Robert Cavanagh
Curtin University of Technology
<cavanagr@spectrum.curtin.edu.au>

Graham Dellar
Curtin University of Technology
<g.dellar@spectrum.curtin.edu.au>

Len Sparrow
Curtin University of Technology
<l.sparrow@spectrum.curtin.edu.au>

A quantitative investigation of 18 Western Australian secondary school mathematics classrooms was conducted prior to implementation of the *Curriculum Framework*. The *Classroom Cultural Elements Questionnaire* was administered to profile existing learning environments. Results revealed learning environments with varying levels of elements conducive to improved learning outcomes. This finding suggests *Curriculum Framework* implementation in mathematics requires attention to these elements of the classroom environment and development of a classroom culture focussed on the educative needs of students rather than traditional subject content.

Current curriculum initiatives in Western Australia centre upon the notion of outcomes-based education. This emphasis is consistent with national and international trends to ensure systemic, school and teacher accountability as a means of improving the educational outcomes of all students (Caldwell, 1993). It signifies a move away from emphasis upon subject centred curriculum delivery towards focus on the learning outcomes of individual students. The *Curriculum Framework* (Curriculum Council, 1998), is characterised by identification of sequential long-term educational goals. By comparison, previous curricula prescribed the objectives of specific courses of study, units of work or years of schooling. Five *Core Values* underpin the *Curriculum Framework*: pursuit of knowledge and achievement of potential; self-acceptance and self-respect; respect and concern for the rights of others; social and civic responsibility; and environmental responsibility. It also contains thirteen *Major Learning Outcomes, which* express the goals of kindergarten, primary and secondary education.

Current discrete subject-based curricula are to be restructured into eight generic learning areas: The Arts; English; Health and Physical Education; LOTE; Mathematics; Science; Society and Environment; and Technology and Enterprise. The *Curriculum Framework* document specifies seven *Key Principles* to guide schools in planning and curriculum development: an encompassing view of the curriculum; an explicit knowledge of the core values; flexibility; inclusivity; integration, breadth and balance; a developmental approach; and collaboration and partnerships. Implementation of the *Curriculum Framework* is anticipated to be particularly consequential for secondary schools with faculty based organisational and curriculum structures. At the classroom level, realisation of the major outcomes will probably necessitate student-centred learning and flexible modes of curriculum delivery. *Curriculum Framework* implementation is anticipated to cause changes in classrooms, which will be evidenced by a shift towards the psycho-sociological learning environment, rather than emphasis on subject-centred content, processes and skills, which characterise many traditional classroom environments.

Aims of the Study

The aim of the investigation described in this paper was to examine prior to *Curriculum Framework* implementation, the presence in secondary school mathematics classroom of attributes expected to be conducive for outcomes-based education implementation. This is the first stage in a longitudinal study of learning environments within the context of major curriculum reform. Although the focus of this inquiry is on mathematics classrooms, concurrent examination of classrooms in the other seven learning areas is also being undertaken. The overall study will utilise a developmental mixed-method approach. The data collected and analysed in this paper is from the quantitative first phase of the overall investigation.

Theoretical Background

The literature on Outcomes-based Education (OBE) frequently differentiates between objectives and outcomes. For example, Griffin (1998) viewed outcomes as having a behavioural orientation concerned with demonstration of student knowledge and skills in comparison to objectives not necessarily specifying student performance. Spady and Marshall (1991) considered OBE to be founded upon three premises: all students can learn and succeed, but do so in different ways and over different periods of time; successful prior learning is the precursor to successful future learning; and schools control the conditions conducive to successful learning. Spady and Marshall (1991) identified three approaches to the use of outcomes in curriculum development: traditional OBE has specification of learning outcomes preceded by decisions about curriculum content and structure; transitional OBE is characterised by de-emphasis of curriculum structure by integration of subject and content areas with focus on student learning; and transformational OBE commences with identification of broad educational outcomes, which then predicate curriculum structure, learning experiences and the organisation of the school.

Notwithstanding the strong local and international support for an outcomes-based approach to curriculum development, teaching and learning, OBE has been subject to criticism. This centres upon concern over the potential for outcomes-based curricula to be narrow, fragmented and behaviourist (Glatthorn, 1993; Towers, 1994).

The *Curriculum Framework* has been developed in cognisance of the potential benefits and disadvantages associated with previous outcomes-based curriculum reform initiatives. The *Curriculum Framework* acknowledges the *Core Values* of society, identifies thirteen *Major Learning Outcomes,* and provides guidelines for school-level implementation. Specification of a general framework rather than a curriculum *per se* is intended to provide overall direction and purpose for curriculum development. However, selection and sequencing of content, skills and learning experiences are to be decided at the school level based upon local circumstances. Adoption of the *Curriculum Framework* is predicated on the assumption school staff will have a clear understanding of the intent of the framework and effect the attainment of broad long term learning outcomes for students. The foundations for constructing the school curriculum are the five *Core Values* and the thirteen *Major Learning Outcomes*.

Researching the effects of the *Curriculum Framework* on schools and classrooms is potentially difficult due to the influence of the local context on school level curriculum planning and actualisation. Curricula across different schools may vary considerably. The approach taken in this study was to consider realisation of *Curriculum Framework* intentions

from the perspective of their effect on classroom learning environments. It was assumed attainment of the cognitive and affective outcomes expressed in the *Major Learning Outcomes* and the *Core Values* by students would be evidenced by the presence of specific beliefs, values, attitudes, norms and resulting behaviour within classrooms. These attributes of a group of people characterise their culture. Donahoe (1993) provided a general definition of culture; "the values, beliefs, behaviours, rules, products, signs and symbols that bind us together" (p.302). The fidelity of *Curriculum Framework* implementation can be assessed by examination of classroom culture.

The *Classroom Cultural Elements Questionnaire (CCEQ)* (Cavanagh, Dellar, Ellett, & Rugutt, 2000) was developed to investigate the psycho-sociological aspects of the classroom learning environment. The theoretical background for instrument development was research literature on school culture, school effectiveness, school improvement, effective teaching and effective learning. Distillation of this literature resulted in identification of five dimensions of an effective classroom culture: educational values of the individual student; involvement of parent(s) in their child's schooling; classroom group; the teacher; and outcomes of learning.

Data from a sample of 682 students in English, Mathematics and Society and Environment classes were factor analysed. The original instrument was refined in consideration of the factor structure matrix and validity of constructs being measured. *CCEQ* refinement resulted in an instrument which profiles the presence of twelve classroom conditions; student educational values, learning outcomes, parental involvement, peer caring, peer discussion, peer emphasis on learning, peer support, student autonomy, teacher caring, teacher control, teacher expectations and teacher support. Many of the conditions examined by the *CCEQ* are consistent with those expected to result from attainment of *Curriculum Framework* outcomes. It is anticipated successful implementation of the *Curriculum Framework* will necessitate and be evidenced by an increased presence of these classroom conditions.

Methodology

The *Classroom Cultural Elements Questionnaire* is comprised of 87 items organised into twelve scales (Table 1) with a four-point Likert scale response facility. The *CCEQ* was administered in two Western Australian secondary schools to 682 Years 8-10 students, 334 students were from 18 mathematics classrooms (Table 2). The need to avoid multiple instrument administration to the same students in different subject areas resulted in the Mathematics sample from one school being entirely Year 8 students.

All of the students present at school on the day of administration were surveyed. The internal reliability of the twelve scales was assessed by Cronbach Alpha analysis of reliability. The capacity of the instrument to discriminate between different classroom groups for each of the twelve constructs was determined by One-way ANOVA analysis of variance with multiple range testing. The validity of the instrument scales to solicit data on classroom culture was examined by consideration of the statistical correlation (Spearman) between the twelve constructs. The differences between individual classroom groups for each of the twelve constructs were identified by One-way ANOVA analysis of variance with the Least Significant Differences Test applied.

Table 1
Classroom Cultural Elements Questionnaire Scales, Sample Items and Scale Size

Scale	Sample Item	No. of Items
Educational Values	My future will be improved by what I learn.	9
Learning Outcomes	I perform to the best of my ability.	13
Parental Involvement	My parent(s) help with my homework.	8
Peer Caring	Students are tolerant of one another.	5
Peer Discussion	We talk about our progress.	6
Peer Emphasis on Learning	We believe that everyone can learn.	6
Peer Support	Students encourage each other to accept challenges.	7
Student Autonomy	We are allowed to commence new work when we are ready.	6
Teacher Caring	We feel safe in this teacher's class.	7
Teacher Control	The teacher expects us to complete our work on time.	5
Teacher Expectations	The teacher expects us to perform to the best of our ability.	4
Teacher Support	The teacher provides us with encouragement.	11

Table 2
Sample Distribution by Group and Year

Group	School	Number of Students	Year Level	Group	School	Number of Students	Year Level
1	1	12	Year Eight	10	2	22	Year Eight
2	1	25	Year Eight	11	2	16	Year Eight
3	1	21	Year Eight	12	2	12	Year Nine
4	1	18	Year Eight	13	2	24	Year Nine
5	1	24	Year Eight	14	2	23	Year Nine
6	1	24	Year Eight	15	2	8	Year Ten
7	1	26	Year Eight	16	2	15	Year Ten
8	2	15	Year Eight	17	2	14	Year Ten
9	2	19	Year Eight	18	2	16	Year Ten

Results

Cronbach Alpha analysis of the internal reliability of data from the twelve scales (Table3) indicates individual respondents responded consistently to the items within each scale. This is evidence of the items within each scale soliciting data on a common construct as administered to this sample.

Table 3
Scale Internal Reliability

Scale	Internal Reliability (Alpha)	Scale	Internal Reliability (Alpha)
Educational Values	0.86	Peer Support	0.89
Learning Outcomes	0.92	Student Autonomy	0.82
Parental Involvement	0.84	Teacher Caring	0.88
Peer Caring	0.84	Teacher Control	0.89
Peer Discussion	0.83	Teacher Expectations	0.84
Peer Emphasis on Learning	0.78	Teacher Support	0.94

One-way ANOVA with multiple range testing was used to examine the capacity of the instrument to discriminate between the classroom learning environments for this sample of 18 class groups Table 4 presents the F ratio and probability value for each of the twelve scales. The results of this analysis indicate the instrument was able to discriminate between the 18 class groups for the twelve constructs under investigation. Spearman correlation coefficients were calculated to examine the relationships amongst the twelve constructs. The data presented in Table 5 is a summary of the inter-scale correlations. The positive correlations between the scales suggest the constructs are inter-related which is supportive of the proposition they collectively represent a common phenomenon. The culture of the classrooms examined are characterised by the twelve constructs or cultural elements investigated and also by inter-dependency between these elements.

Table 4
Cceq Capacity to Discriminate between Different Class Groups (One-way Anova)

Scale	F ratio	F probability	Scale	F ratio	F probability
Educational Values	2.27	0.003	Peer Support	2.34	0.002
Learning Outcomes	3.90	0.000	Student Autonomy	3.40	0.000
Parental Involvement	3.27	0.000	Teacher Caring	5.20	0.000
Peer Caring	4.09	0.000	Teacher Control	4.34	0.000
Peer Discussion	4.52	0.000	Teacher Expectations	4.82	0.000
Peer Emphasis on Learning	2.33	0.002	Teacher Support	5.49	0.000

Table 5
Range of Inter-Scale Corrleation Coefficients (Spearman)

Scale	Range of Inter-scale Correlation (Spearman)	Scale	Range of Inter-scale Correlation (Spearman)
Educational Values	0.59 - 0.15	Peer Support	0.74 - 0.34
Learning Outcomes	0.63 - 0.43	Student Autonomy	0.54 - 0.14
Parental Involvement	0.53 - 0.30	Teacher Caring	0.81 - 0.27
Peer Caring	0.74 - 0.33	Teacher Control	0.67 - 0.28
Peer Discussion	0.63 - 0.44	Teacher Expectations	0.71 - 0.31
Peer Emphasis on Learning	0.61 - 0.39	Teacher Support	0.81 - 0.36

Scale mean scores were adjusted by being dividing by the number of items within each scale so the range of means across the 18 class groups would correspond to the four-point Likert scale on the questionnaire. Adjusted scores below 2.0 indicate "disagree"/ "strongly disagree" and those above 3.0 indicate "agree"/ "strongly Agree". One-way ANOVA analysis of variance with the Least Significant Differences Test (LSD) was utilised to determine the number class groups with statistically significantly ($p<0.05$) different scale mean scores. This test provides only relative data since if one group is significantly lower, then the remainder of the groups are counted as being higher. Table 6 presents the range of adjusted scale mean scores and the number of significantly different groups for each scale. The data in Table 6 indicates differences in classroom culture for the twelve elements being investigated.

When the LSD test results are considered, the lower range adjusted scale mean scores for *Parental Involvement, Peer Discussion, Student Autonomy* and *Teacher Support* are probably from only one group for each scale respectively. In the majority of classes the scale mean scores are above 2.0 which is indicative of the presence of the twelve elements within the classrooms. However, affirmative responses, "agree"/ "strongly agree" would produce scale mean scores greater than 3.0. Only responses to *Educational Values* and *Teacher Expectations* are in this range. Although the other 10 classroom cultural elements are present in the majority of the mathematics classrooms investigated, students have not consistently affirmed their presence.

Table 6

Range of Adjusted Scale Mean Scores and Number of Classes with Statistically Significant Higher Mean Scale Scores

Scale	Range of Adjusted Scale Mean Scores	Number of Classes	Scale	Range of Adjusted Scale Mean Scores	Number of Classes
Educational Values	3.4- 4.0	11	Peer Support	2.3 - 3.0	7
Learning Outcomes	2.1 - 3.0	16	Student Autonomy	1.7 - 2.7	17
Parental Involvement	1.8 - 2.7	17	Teacher Caring	2.3 - 2.8	17
Peer Caring	2.2 - 3.2	11	Teacher Control	2.4 - 3.4	17
Peer Discussion	1.9 - 3.1	17	Teacher Expectations	3.0 - 4.0	15
Peer Emphasis on Learning	2.6 - 3.2	13	Teacher Support	1.9 - 3.3	17

Discussion and Significance of the Study

Analysis of the results of CCEQ administration in this study has revealed the constructs were reliably measured. The extent of inter-scale correlation supports the proposition of the twelve cultural elements being inter-related and collectively representing the higher order construct of classroom culture. This finding is consistent with previous school culture research and the consequent theoretical conceptions of school culture (Cavanagh & Dellar, 1997, 1998). The *Learning Outcomes* element is a significant component of classroom culture, and the range of inter-scale correlations indicates its relationship with the other eleven elements. Although it could be considered as the outcome of an effective classroom culture, this element is both a vehicle for classroom improvement and a component of an effective classroom culture. Successful prior learning provides motivation for future learning and strongly influences satisfaction with schooling (Samdal, Wold, & Bronis, 1999).

Apart from the specific applicability of the *CCEQ* in assessing *Curriculum Framework* implementation, it also has general application in the design and execution of teacher professional development activities to support curriculum improvement and enhance student learning outcomes. The notion of an effective classroom culture characterised by the twelve cultural elements provides teachers with an alternative perspective on the classroom environment. The data obtained from the *CCEQ* informs teachers about the nature of the prevailing cultural elements within traditional mathematics classrooms. It also emphasises that effective implementation of curriculum change (*Curriculum Frameworks)* is underpinned by and built upon the current classroom culture. Data on the prevailing classroom culture also profiles the readiness of the teacher and students to engage in classroom improvement.

The study has confirmed the appropriateness and utility of the *Classroom Cultural Elements Questionnaire* in examining mathematics learning environments through a classroom culture orientation. Consistency between the major outcomes of the *Curriculum Framework* and the constructs examined by the *CCEQ* has enabled the results of the quantitative investigation to profile elements of prevailing mathematics classroom culture of relevance to the intentions of the *Curriculum Framework.*

References

Caldwell, B. J. (1993). Paradox and uncertainty in the governance of education. H. Beare & W. L. Boyd, W. L. (Eds), *Restructuring schools: An international perspective on the movement to transfer the control and performance of schools* (pp. 158-173) London: The Falmer Press.

Cavanagh, R. F. & Dellar, G. B. (1997). *Towards a model of school culture.* Paper presented at the 1997 annual meeting of the American Educational Research Association. Chicago.

Cavanagh, R. F. & Dellar, G. B. (1998). *The development, maintenance and transformation of school culture.* Paper presented at the 1998 annual meeting of the American Educational Research Association. San Diego.

Cavanagh, R.F., Dellar, G.B., Ellett, C. & Rugutt J. (2000). *Development of an instrument to profile learning environment attributes in different secondary school classrooms.* Paper prepared for presentation at the 2000 annual meeting of the American Educational Research Association. New Orleans.

Curriculum Council. (1998). *Curriculum framework.* Perth: Curriculum Council of Western Australia.

Glatthorn, A. A. (1993). OBE reform and the curriculum process. *Journal of Curriculum and Supervision, 8*(4), 354-363.

Griffin, P. (1998). Outcomes and profiles: Changes in teachers' assessment practices. *Curriculum Perspectives, 18*(1), 9-19.

Samdal, O., Wold, B. & Bronis, M. (1999). Relationship between students' perceptions of school environment, their satisfaction with school and perceived academic achievement: An international study. *School Effectiveness and School Improvement, 10*(3), 296-320.

Spady, W. G. and Marshall, K. J. (1991). Beyond traditional outcomes-based education. *Educational Leadership, 49*(2), 67-72.

Towers, J. M. (1994). The perils of outcome-based teacher education. *Phi Delta Kappan, 4*, 624-627.